Our water.
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Paradise Irrigation District

DRAFT

WATER SYSTEM RECOVERY PLAN

April 12, 2019

List of Reports

Paradise Irrigation District
Water System Recovery Plan
Summary

Date: April 12, 2019
Prepared by: Sami Kader, P.E.
Checked by: Michael Lindquist, P.E.; Sheila Magladry, P.E.

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Background

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Science of Wildfire-driven VOC Contamination of a Water Distribution System

The science of wildfire-driven VOC contamination of a water distribution system is new, not completely understood, and an area of ongoing research. In order to help guide the development of the Recovery Plan, we have reviewed the available scientific information and used it to give us the highest level of confidence that testing can be completed with a method that will engender confidence in the results. There are a few basic results of the available research that have informed our decisions.

- During a wildfire, and especially in conjunction with depressurization, contaminants (especially VOCs) can get drawn into the water distribution system. It is suspected that these contaminants are drawn in as a gas.
- Some of those VOCs can end up adsorbing (soaking) into the walls of the pipe in the water distribution system. This can happen with any type of pipe but has been observed mostly in polyethylene pipe.
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- Although several VOCs have been observed in post-wildfire water distribution systems, benzene has been the most common.

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Anatomy of a Water Distribution System

In order to understand the plan to recover the water system, it is good to have a basic understanding of the anatomy of a water distribution system. Figure 1 illustrates a typical water service connection:

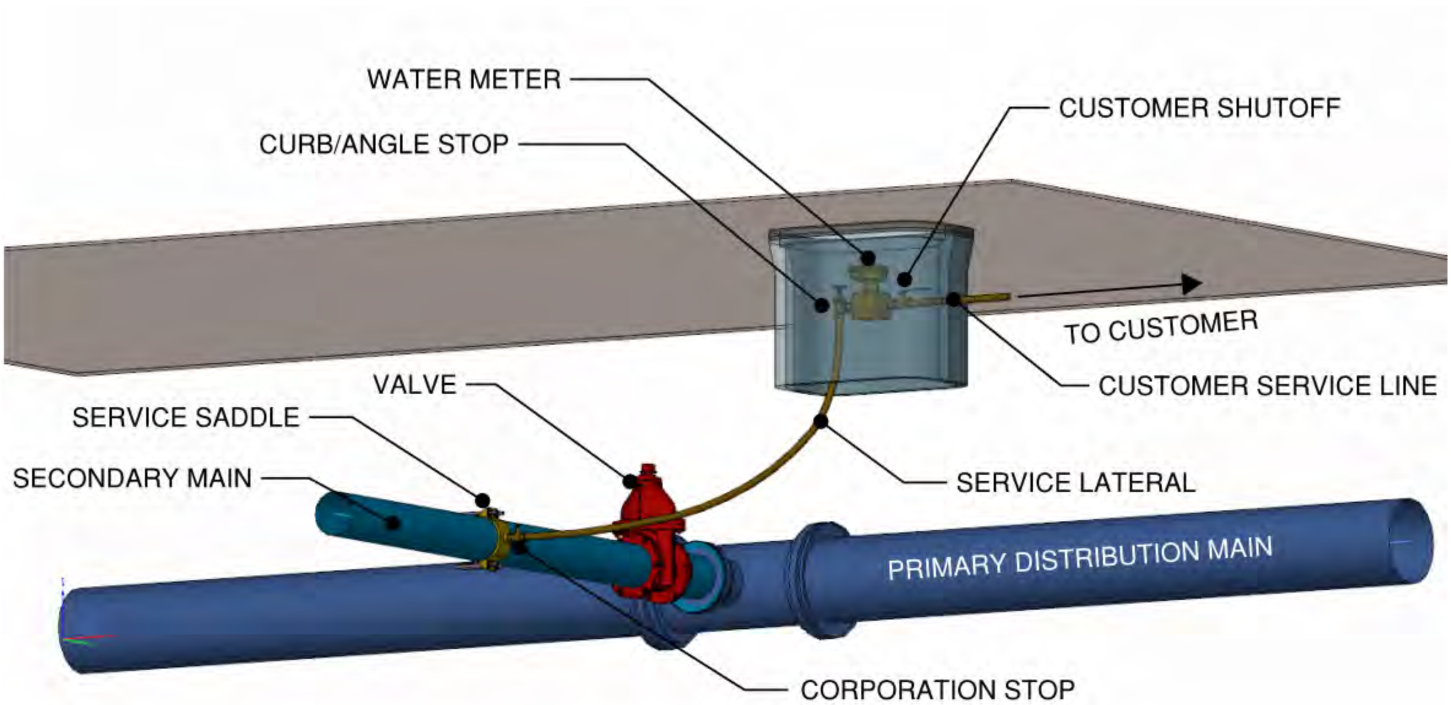

Figure 1. Water Distribution System Anatomy

1. Transmission Main – Pipes which have no services on them which feed Distribution Mains
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13. Appurtenance – fire hydrants, blow offs, air release valves, pressure reducing valves, main valves

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The Water System Recovery Plan consists of the following basic steps:

1. Sample all service laterals and mains in the distribution system for VOCs. This will eventually total nearly 20,000 samples
2. Replace contaminated service laterals and flush contaminated mains
3. Restore potable water service to the system

These steps will be accomplished by executing five Actions

1. Temporary Customer Supply
2. Recover Water Meters and Appurtenances
3. Sample Mains and Service Laterals
4. Repair, Replace Damaged System Components
5. Reconnect Customers to Distribution System

Each of these five Actions has been evaluated to determine the best approach from a cost, effectiveness and schedule standpoint and the preferred approach for each Action recommended. That evaluation is detailed in Justification Reports for each Action. The Water System Recovery Plan does not address potential damage to PID's five water storage tanks. The following summarizes each Action which will be executed.

Temporary Customer Supply (Action 1)

The purpose of the Temporary Customer Supply Action is two-fold.

First, it is to provide the means to continue supply of non-potable water (continuing use under the "Do Not Drink" advisory while the water system is tested. This will be done on a sample area by sample area basis in order to reduce the number of Temporary Customer Supplies that are needed and improve overall schedule performance of system restoration. These temporary sources are anticipated to be in place at a location for 1-2 weeks.

To support stagnation:

1. Where possible, Temporary Customer Supply will be above-grade pipe/hose from a service lateral outside of the Sample Area to provide normal flows to the customer during sampling.
2. In some cases, Temporary Customer Supply will be a tank and booster pump providing non-potable domestic use flows only.
3. Once sampling of stagnated water lines is completed, the temporary water supply will be removed, and the customer reconnected to the PID water system.

Second, longer-term temporary storage will provide the means to continue supply of non-potable water to individual residences which are in parts of the distribution system which may have to be isolated in the course of Plan execution. Longer-term temporary customer supply will be provided in the same way as the short-term temporary customer supply. Where tanks are supplied for these longer-term temporary customer supply systems, those tanks will be likely larger in size in order to make delivery more practical.

Recover Water Meters and Appurtenances (Action 2)

Due to the destruction, water meters and appurtenances are difficult to locate and at times are under debris. The first step in testing the system will be to recover all meters and appurtenances so that sampling can be completed in an efficient manner.

1. Locate meters.
    a. This will involve pipe locating companies locating buried mains and service laterals, as well as field crews finding meter boxes which can be buried under debris or hidden by landscaping
2. Close the curb stop of inactive services
3. Remove all meters and replace them with sample manifolds.

Sample Mains and Service Laterals (Action 3)

Sampling is the core of the overall program. The key to this Action is to sample efficiently, effectively, and to have a sampling, validation and data management plan that will engender confidence in the results.

1. The sampling approach will use a 72-hour stagnation period.
2. Coordinate stagnation period.
    a. In order to continue to supply water to customers during testing, system will be testing in small Sample Areas (typically a single street or cul-de-sac). Temporary Customer Supply, procured in Action 1, will be provided in order to provide continuous water service to existing occupied structures during testing.
3. Test all Samples
    a. Test results will be made public through the geographic information system (GIS) mapping available on the PID website as soon as the data is checked and validated. GIS mapping will be made available to the public at the PID office
4. Restore Supply to Sample Area
    a. While the samples taken are being tested and the data assessed, water supply will be restored to each Sample Area. The "Do Not Drink" advisory will remain in effect until sample results are completed and PID has lifted the "Do Not Drink" advisory for each specific property.

Repair/Replacement of Damaged System Components (Action 4)

Once test results have been received, the repair and replacement of damaged system components will take place. The following steps will be taken if any contaminant is measured over the detection limit:

1. Replace any service lateral with any contaminant over the *MCL*. Flushing for decontamination of service laterals is extremely time consuming and expensive.
2. Flush any service lateral that is over the *detection limit*, but below the *MCL*. Retest after a minimum of two flushings. If retest is not below the detection limit, replace the service lateral.
3. Flush any main over the *detection limit* and re-test. It is suspected that main contamination may be in the water only, not in the pipe walls, and even limited flushing may eliminate the contamination.
4. Replace any main with results above the *MCL*.
5. The work replacing and flushing service laterals and mains may result in system interruptions
    a. May require short-term interruption in service (goal of < 12 hours)
    b. May require longer term interruption in service. Temporary Customer Supply would be provided as described above

Reconnect Customers to the Distribution System (Action 5)

Following System Restoration, Paradise Irrigation District will reconnect customers to the distribution system. PID will work to lift the "Do Not Drink" order for areas which have been found to be clear of contamination or have had contaminated system components isolated or replaced. Meters will be installed for customers in those areas.

1. The lifting of the "Do Not Drink" advisory will be done area by area as testing and replacements are completed.
2. Lifting of the "Do Not Drink" advisory will be communicated to the public via the GIS mapping on the PID Website according to APN.
3. When the "Do Not Drink" advisory is lifted for an area, new meters will be installed in all active services in the area.

Plan Implementation

Detailed Implementation Plans have been prepared for all five of the Actions described above. In general, all five Actions will need to go through a procurement process, contractors and consultants hired, and the five contracts managed through execution so that the work is performed in a cascading schedule, with each Action working through the system before the next.

Cost Estimate Summary

Costs have been estimated for all of the Actions. Table 1 is a summary of the current cost estimates:

Table 1. Cost Estimate Summary

Action	Title	Preferred Alternative Cost Estimate
1	Temporary Supply	$3,200,000
2a	Recover Meters	$7,000,000
2b	Recover Appurtenances	$5,700,000
3a	Sample Mains, Services, and Appurtenances	$9,700,000
4	Repair, Replace Damaged System Components	$20,200,000
5	Reconnect Customers	$7,500,000
	Total	**$53,300,000**

Given the costs involved, a formal procurement process will be required to implement these Actions. It will take several months to go through the procurement process to competitively procure and hire contractors and service providers to perform the work. Given this, we would expect contract work on the ground to begin in late summer 2019.

Completion of all of the steps above for the entire water distribution system will take up to 24 months with anticipated plan completion in early 2021. Although each step can be started shortly after the previous step starts, and the work performed sequentially throughout the system, the sheer volume of work required to completely characterize the system requires that amount of time to complete.

Prioritization

It is recognized that in order to support the rebuilding and revitalization of Paradise, it would be beneficial for 1) restoration of potable water service to currently standing structures be prioritized and 2) for work to progress as quickly as possible. To this end, the following steps have been taken:

1. The water distribution system was divided into over 8000 pipe segments in order to determine the relative importance of each pipe segment in providing water to existing standing structures
2. Categorization of mains. Each main was categorized based on the number of downstream standing structures it serves. Four categories were established, with subcategories.
    a. Category 1 – Primary Distribution Mains (>100 meters serving standing structures flow through that pipe segment)
    b. Category 2 – Secondary Mains with multiple meters serving standing structures flowing through that pipe segment
        i. 2a: 76-100
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    c. Category 3 – Secondary Mains with a single meter serving standing structures
    d. Category 4 – Secondary Mains with no meters serving standing structures

Almost 50% of the mains in the PID distribution system are Category 4. These mains and services will be sampled and cleared last, allowing focus on the mains which serve standing structures. This will allow the restoration of potable water service to standing structures much sooner.

Work will begin with Category 1 mains, and proceed through all of Category 2, then Category 3, working on each Category from A zone through G zone. With this approach, mains in lower zones which serve multiple standing structures (Categories 1 and 2) will be tested and service restored prior to those in upper zones that serve a single standing structure (Category 3). **In this manner, potable water service will be restored to the most people the fastest.** The categorization mapping will be continuously updated, however, preliminary mapping (Figure 2) describes the initial priority pattern in testing and restoring water mains. It should be noted that this figure is very preliminary and does not represent a final prioritization of categories. It is provided only to illustrate the technique being used to prioritize the work and provide potable water to the most standing structures as fast as possible. This tool will be continuously refined and updated in order to drive decision making on where to deploy resources throughout the execution of the program.

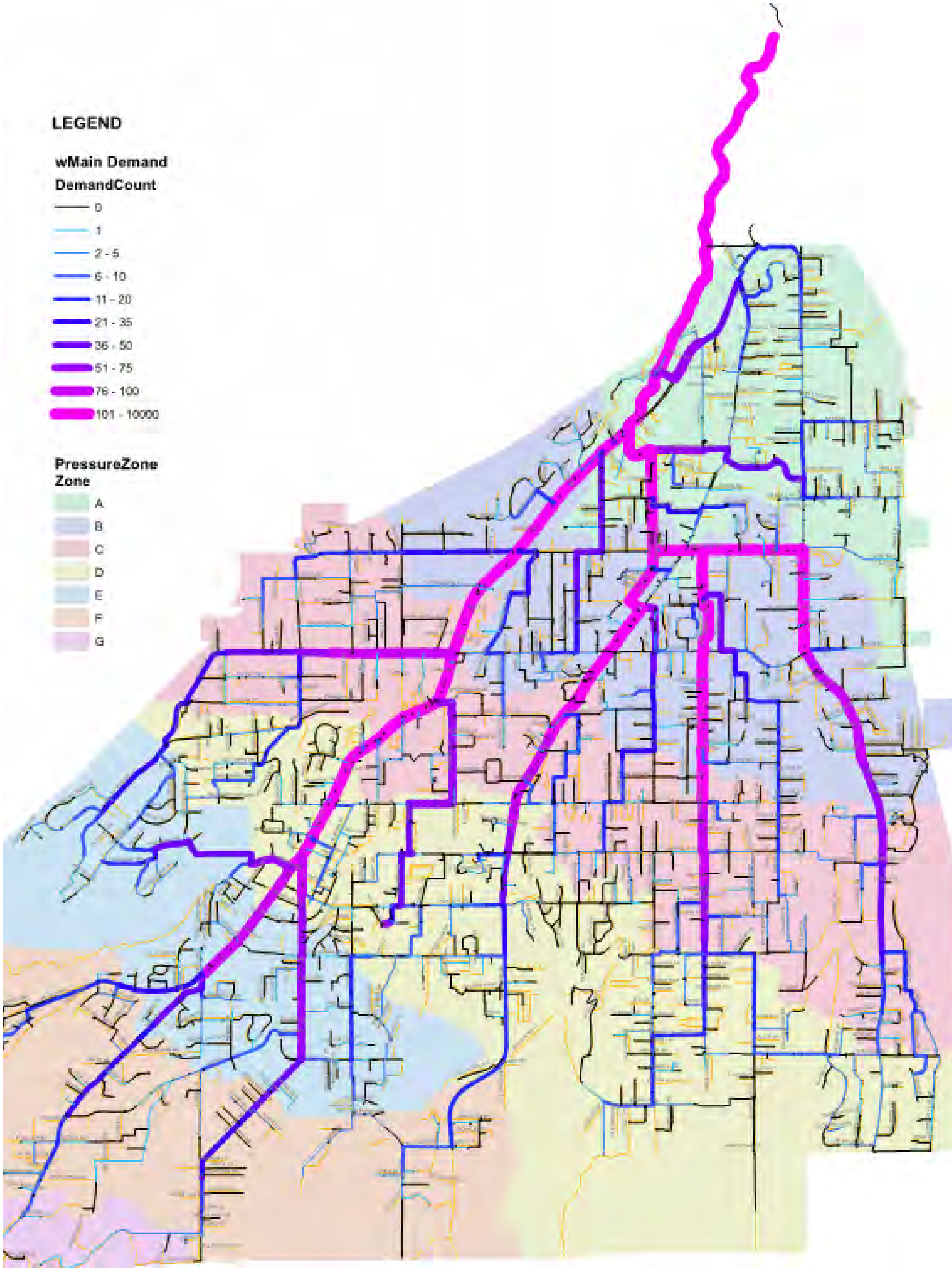

Figure 2. Water Main Categorization by Standing Structures Served

Schedule Milestones

A detailed critical path method (CPM) schedule has been developed for this plan. Using this categorization of mains and prioritization of activities, it is estimated that potable water service could be established with the preliminary target schedule milestones listed in Table 2.

Table 2. Preliminary Target Schedule Milestones

Number of Services	Approximate Standing Structures Included	Preliminary Target Schedule Milestones			
		Meters Recovered	Sampling Completed	Repair/Replacement Completed	Re-Establish Potable Water Service
1500	250	September 2019	October 2019	November 2019	November 2019
3000	450	October 2019	November 2019	January 2020	January 2020
4500	740	December 2019	January 2020	February 2020	March 2020
6000	1350 (all currently standing structures + submitted permits)	January 2020	February 2020	April 2020	June 2020
10400	All Services	June 2020	August 2020	December 2020	February 2021

It is hoped that the contamination of the system is not widespread and is generally limited to a small fraction of services laterals. Consistent clean results will make testing and clearing the system go much faster and allow this schedule to be greatly improved upon. A major goal of this program is to restore public confidence in the distribution system. To that end, Paradise Irrigation District will become one of the most, if not the most densely sampled and tested public water system of all time. As the sample data is amassed, a more clear picture of the extent of the contamination will emerge, resulting in a distribution system which can be confidently returned to potable service as quickly as possible.

Pilot Testing of Recovery Procedures

The recovery of the water distribution system is a complex process that will require coordination of the tasks summarized in this memo. In order to "shake out" that coordination, a test period is desirable. Additionally, in order to perform all of these tasks at full-scale within the preliminary target schedule milestones, consulting and contracting firms must be hired. This will require a procurement period for each task, which will last approximately 2 months (this will occur in the summer of 2019). Given these requirements, Paradise Irrigation District will begin pilot testing the procedures described for each of these tasks using District staff to perform the work as soon as possible. This pilot testing will be directed towards the Category 1 mains, with the goal of testing the main along Skyway first, in order to return potable water service in that commercial corridor as soon as possible. Lessons learned from the pilot testing will be incorporated into the execution of the contract work as consulting and contracting firms are hired and begin work. Pilot testing will continue working on all Category 1 mains and contract work will pick up from the point where PID forces leave off. Pilot testing may involve the use of mutual aid and other resources, as it is feasible to manage and implement.

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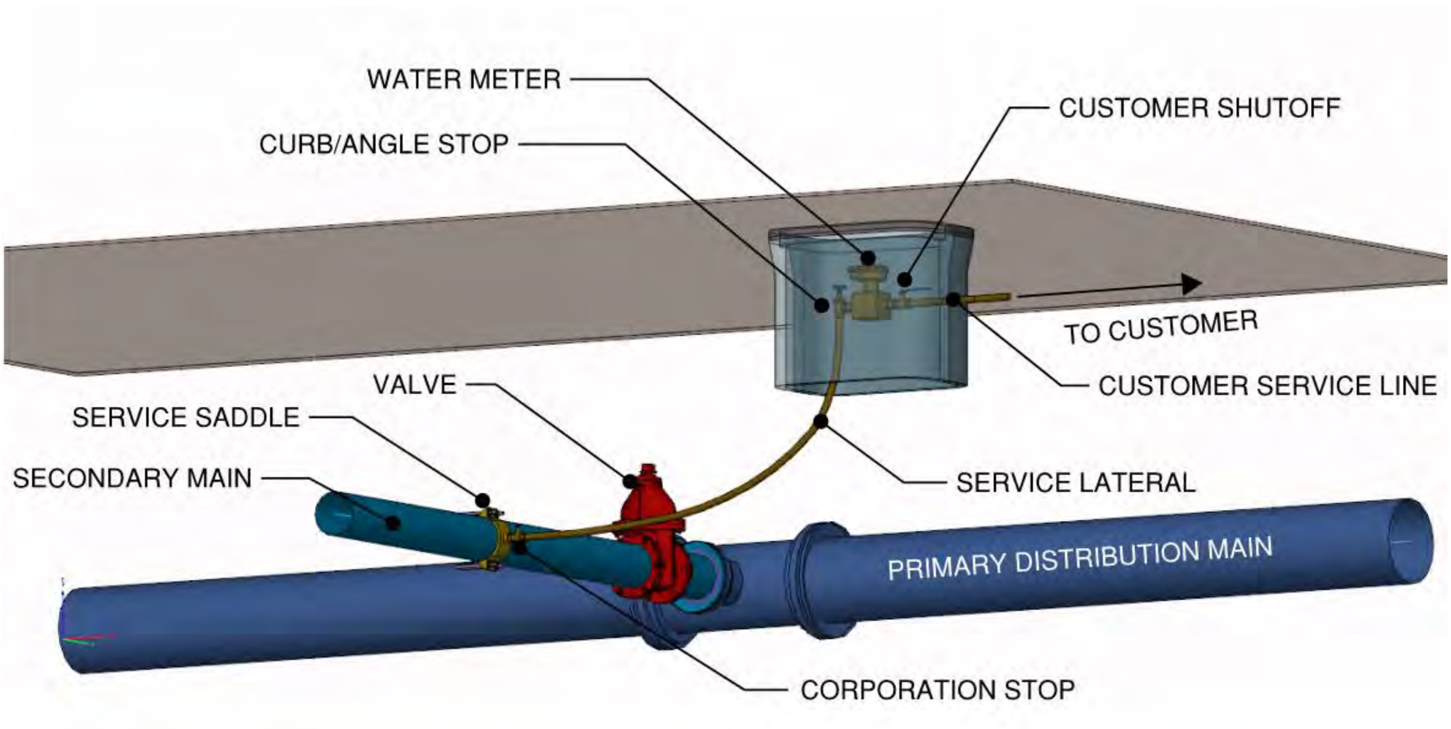

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3a	Sample Mains, Services, and Appurtenances	$8,100,000
4	Repair, Replace Damaged System Components	$18,200,000
5	Reconnect Customers	$7,500,000
	Total	**$49,700,000**

Given the costs involved, a formal procurement process will be required to implement these Actions. It will take several months to go through the procurement process to competitively procure and hire contractors and service providers to perform the work. Given this, we would expect contract work on the ground to begin in late summer 2019.

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    c. Category 3 – Secondary Mains with a single meter serving standing structures
    d. Category 4 – Secondary Mains with no meters serving standing structures

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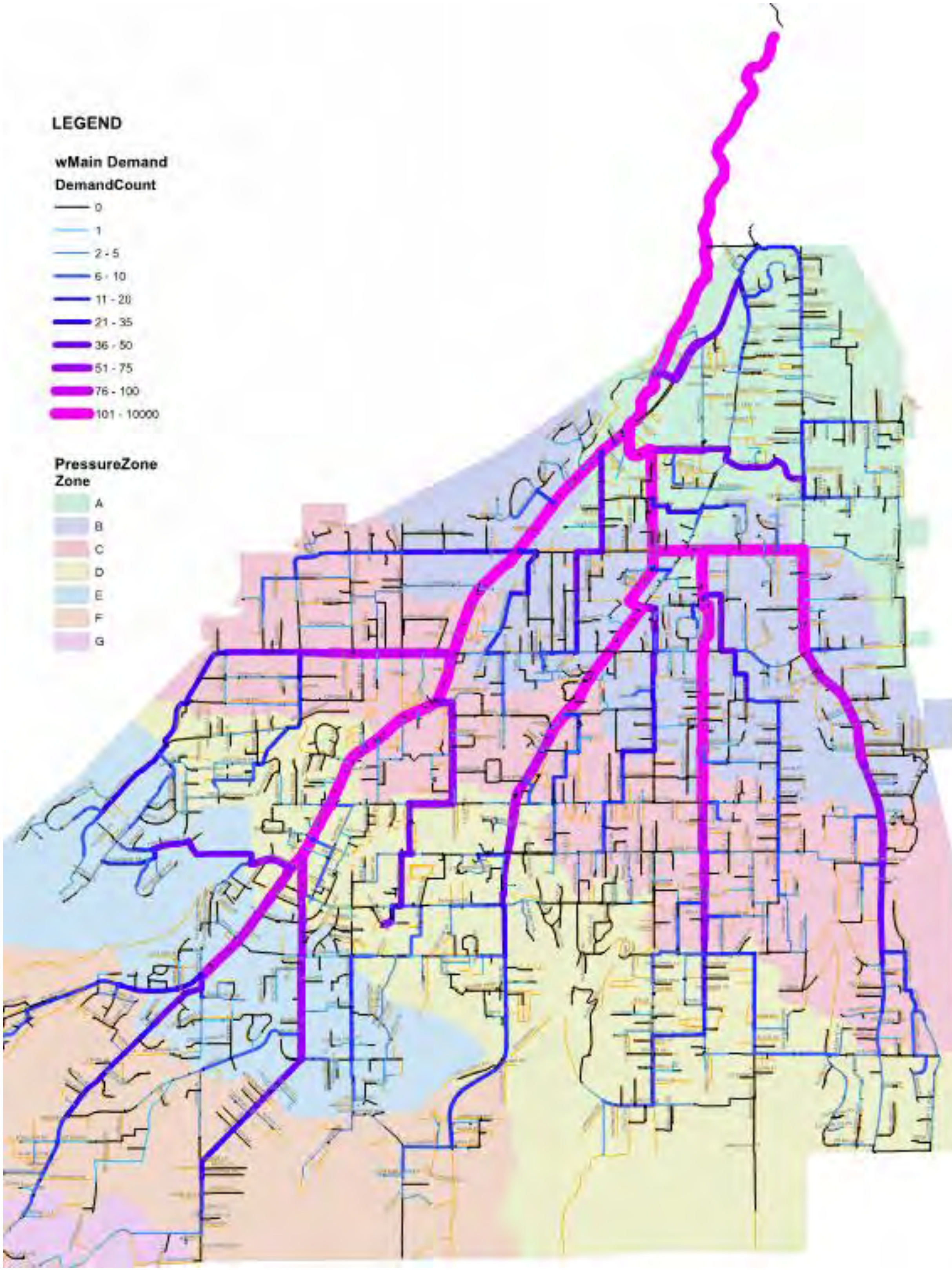

Figure 2. Water Main Categorization by Standing Structures Served

Schedule Milestones

A detailed critical path method (CPM) schedule has been developed for this plan. Using this categorization of mains and prioritization of activities, it is estimated that potable water service could be established with the preliminary target schedule milestones listed in Table 2.

Table 2. Preliminary Target Schedule Milestones

Number of Services	Approximate Standing Structures Included	Preliminary Target Schedule Milestones			
		Meters Recovered	Sampling Completed	Repair/Replacement Completed	Re-Establish Potable Water Service
1500	250	September 2019	October 2019	November 2019	November 2019
3000	450	October 2019	November 2019	January 2020	January 2020
4500	740	December 2019	January 2020	February 2020	March 2020
6000	1350 (all currently standing structures + submitted permits)	January 2020	February 2020	April 2020	June 2020
10400	All Services	June 2020	August 2020	December 2020	February 2021

It is hoped that the contamination of the system is not widespread and is generally limited to a small fraction of services laterals. Consistent clean results will make testing and clearing the system go much faster and allow this schedule to be greatly improved upon. A major goal of this program is to restore public confidence in the distribution system. To that end, Paradise Irrigation District will become one of the most, if not the most densely sampled and tested public water system of all time. As the sample data is amassed, a more clear picture of the extent of the contamination will emerge, resulting in a distribution system which can be confidently returned to potable service as quickly as possible.

Pilot Testing of Recovery Procedures

The recovery of the water distribution system is a complex process that will require coordination of the tasks summarized in this memo. In order to "shake out" that coordination, a test period is desirable. Additionally, in order to perform all of these tasks at full-scale within the preliminary target schedule milestones, consulting and contracting firms must be hired. This will require a procurement period for each task, which will last approximately 2 months (this will occur in the summer of 2019). Given these requirements, Paradise Irrigation District will begin pilot testing the procedures described for each of these tasks using District staff to perform the work as soon as possible. This pilot testing will be directed towards the Category 1 mains, with the goal of testing the main along Skyway first, in order to return potable water service in that commercial corridor as soon as possible. Lessons learned from the pilot testing will be incorporated into the execution of the contract work as consulting and contracting firms are hired and begin work. Pilot testing will continue working on all Category 1 mains and contract work will pick up from the point where PID forces leave off. Pilot testing may involve the use of mutual aid and other resources, as it is feasible to manage and implement.

Paradise Irrigation District
Water System Recovery Plan
Temporary Customer Supply – Justification Report

Date: April 12, 2019
Prepared by: Sheila Magladry, P.E.
Checked by: Michael Lindquist, P.E.

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Damage Description

The Camp Fire of 2018, the deadliest and most destructive wildfire in California history to date, destroyed approximately 87% of buildings in Paradise, CA. PID estimates there are approximately 1300 remaining standing structures: 1045 standing residential buildings and 267 standing businesses. The pre-fire service count was 10,480.

The extent of damage to the water system is unknown. Preliminary sampling efforts showed positive contamination results in numerous water services. The extent of contamination is unknown. PID is providing non-potable water to services via the damaged distribution system. PID has issued a limited-contact order for all water service locations.

Purpose of Action

A system-wide sampling action will be implemented to determine the extent of contamination. A 72-hour stagnation period is required before the sampling so the pipes can be accurately tested for contamination. The Temporary Customer Supply will provide potable or non-potable water to the PID customers while the distribution system is undergoing sampling and repair activities.

The supply action will include water delivery, storage and pressurization abilities. The temporary supply must be provided in a time efficient manner so the sampling and repair activities can commence. The temporary supply must meet water quality standards that are concurrent with or exceed the current quality standards provided by PID.

For the purpose of estimation, it is assumed all occupiable structures will be provided temporary water supply.

Action Alternatives

Alternative 1: System Wide Temporary Water Supply

Scope

The system wide alternative prioritizes removing customers from PID supply entirely so the system can be prepared for sampling. The assumed number of occupiable structures is 13% of the entire system; this is the number of remaining structures plus 20% growth. This temporary supply would provide potable water to all occupiable structures for an extended period required to complete the temporary supply implementation and sampling and repair programs. The on-site storage volume will account for indoor and outdoor use patterns. Each occupiable structure would be supplied with a temporary water supply equipment package including:

1. Storage tank for a week's worth of single service supply (2000-gallons)
2. Booster pump pressurize water from storage to service
3. Pressure tank for reliable pressure supply to customer

The installation and maintenance requirements for this alternative include:

1. Connect plumbing from supply to service
2. Connect pump station to house electrical service panel
3. Provide potable water delivery on a weekly delivery schedule
4. System Maintenance and water quality inspections
5. Removal and salvage of equipment following action completion

Estimated Cost

The estimated cost to implement this alternative includes equipment acquisition, installation and maintenance for a 1-year timeframe. This timeframe is an absolute minimum required to complete temporary supply installation and system sampling and repair activities.

Estimated Schedule

The temporary supply schedule assumes the equipment would be provided to each service location at a rate of 3 crews installing temporary supply for 4 customers per day. However, it could take a few months to even acquire the equipment for all residential services.

Alternative 2: Sequential Temporary Water Supply

Scope

The sequential supply alternative prioritizes customer location and main sampling and recovery in conjunction with temporary supply. This strategy reduces the total number of supply packages required as only customers whose supply mains and service laterals are undergoing sampling and/or repair activities will be provided temporary supply. This temporary supply alternative would provide non-potable water to customers for approximately a week while sampling and/or repair activities are being implemented. Storage volume would account for indoor use patterns only. The customers will be asked to limit outdoor use patterns for the week they are under temporary supply. This supply equipment package would include:

1. Storage tank for a week's worth of single service supply (1000-gallons)
2. Booster pump pressurize water from storage to service
3. Pressure tank for reliable pressure supply to customer
4. Trailer mounted design for delivery and relocation

The installation and maintenance requirements for this alternative include:

1. Connect plumbing from supply to service
2. Connect pump station to house electrical service panel
3. Removal and salvage of equipment following sequence completion.

Estimated Cost

The estimated cost to implement this alternative includes equipment acquisition, installation and maintenance for a single week to complete portions of sampling and repair activities. The temporary storage will be provided to match the sampling rates, approximately 100 services per week.

Estimated Schedule

The temporary supply would be provided to match the rate of sampling activities, assumed to be a 1-week period. Installation will be phased to match the sampling sequence with 3 crews installing 4 tanks per day. The sampling procedures will be scheduled to follow the temporary installations.

Alternative 3: Adjacent Customer Supply

Scope

Adjacent Customer Supply will connect temporary supply hoses from the service requiring supply to adjacent service laterals supplied by adjacent mains which are not undergoing sampling activities. This method will only be feasible in locations where the service location is relatively close (a couple hundred feet) to another service lateral which is viable for connection. This alternative does not require onsite storage or pressurization. This alternative will be implemented similar to alternative 2 where it will proceed the sampling activity schedule. This alternative will also supply non-potable water.

Estimated Cost

Cost for this alternative was calculated assuming a sequence would supply 100 customers. Once the sampling or repair sequence is completed, the materials would be relocated to the next sequence.

Estimated Schedule

Once the hose material is procured, temporary connections can be installed in a manner of hours per connection. Installations can be completed at a rate of 7 installations a day with 10 crews. Supply from an adjacent service lateral can be for as short or as long a period as desired, and there is no additional maintenance, operation, or refilling of the supply required.

Alternative 4: Combination of Alternatives 2 and 3

It is likely Alternative 3 cannot be incorporated at all occupiable structures undergoing sampling activities, so Alternative 4 combines 80% of hose over connections in Alternative 3 with 20% of the temporary supply packages from Alternative 2 for 100 total temporary supplied customers within a sequence. The temporary supply packages will be supplied based on the need of individual customers not meeting the requirements for Adjacent Supply and will only be provided while that main section is undergoing sampling. The storage volume for the supply package will be determined by the service location and schedule for repair. The short-term temporary supply does not require PID to provide potable water to all customers as it is assumed those customer's water supply will be repaired and potable in a reasonable amount of time.

Estimated Cost

The cost estimate for the short-term temporary supply is estimated according to the sampling schedule. The sampling schedule aims to complete the sampling of occupiable structures within 12 weeks, so therefore roughly 100 temporary supplies will be required at one time.

Estimated Schedule

The installation will be coordinated with sampling and will be staffed so it can be completed in a time efficient manner.

Alternative Selection

The alternatives were assessed based on the ease with which they meet the action goals. Providing temporary supply to 13% of the system before beginning sampling and repair activities does not meet the goal of readily repairing the system. This may be the fastest alternative to providing potable water, but it hinders the completion of the system repair action, and it is not preferred from a water quality standpoint as each temporary supply location will require maintenance and water quality testing to assume the supply is potable. It is also the most costly and time-consuming method to provide an individual with potable water. By sequencing the temporary supply, portions of the system will be "cleared" of contamination or repaired following the sampling efforts. Customers will be provided permanent potable water by the distribution system more efficiently and will not have to rely on temporary storage for an extended period of time.

Table 1: Alternative Comparison

Alternative	Alt 1: System-Wide Supply	Alt 2: Sequential Supply	Alt 3: Adjacent Supply	Alt 4: Combination of 2 and 3
Estimated Cost	$35 Million	$4 Million	$0.8 Million	$1.8 Million
Implementation Schedule	8 months	8 days	2 days	3 days
Installation Crew	3 crews with 2 installations per day	3 crews with 4 installations per day	10 crews with 7 installations per day	Combination of both 2 and 3
Time Under Temporary Supply	One year	One week	One week, or as needed	One week, or as needed
Potable or Non-Potable	Potable	Non-Potable	Non-Potable	Non-Potable
Effect on Sampling and Repair Activities	Delays sampling and repair activates until all occupiable structures have a temporary supply	Improves the timeline on sampling and repair activities as temporary supply is implemented in sequence with sampling	Fastest timeframe for acquiring materials and installation. Not inhibited by storage volume requirements.	Combination of 2 and 3

Customers in Locations with Low Sampling Priority

The selected temporary customer supply method will generally precede the sampling schedule. However, there is the potential need to isolate mains which serve individual residences in the course of Plan execution. In the situation where an occupiable structure is supplied by an isolated main, this customer will be provided temporary non-potable supply. Longer-term temporary customer supply will be provided in the same way as the short-term temporary customer supply. Where tanks are supplied for these longer-term temporary customer supply systems, those tanks will be likely larger in size in order to make delivery more practical.

Paradise Irrigation District
Water System Recovery Plan
Temporary Customer Supply – Implementation Plan

Date: April 12, 2019
Prepared by: Sheila Magladry, P.E.
Checked by: Michael Lindquist, P.E.

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Action Description

The temporary customer supply action will include potable water delivery, storage and pressurization abilities. The temporary supply must be provided in a time efficient manner so the sampling and repair activities can commence. The temporary supply must meet water quality standards that are concurrent with or exceed the current quality standards provided by PID.

The action justification report recommended providing non-potable temporary supply to customers in conjunction with the sampling action plan. The temporary supply will be a combination of hose-over connections from nearby mains and services, and for those who cannot be supplied in that manner temporary on-site storage and booster pump skids. Those customers whose mains have been isolated will be provided with temporary non-potable water supply using onsite storage tanks and booster pump skids.

Sequential Temporary Water Supply

The sequential supply alternative prioritizes customer location, recovery and sampling in conjunction with temporary supply.

Hose-Over Connection

Customers in nearby proximity to service laterals supplied by mains not undergoing a sampling activity will have a hose-over connection for temporary supply. The hose over supply will connect to the sample manifold connection installed as part of the meter recovery process. This supply will be pressurized by the distribution system. The hose will run above grade to the sample manifold connection at the customer's service line. This method has potential for vandalism and contamination due to the length of exposed line. The hose distance will be minimized, and the customer will be advised to make daily observations of the hose over line. The temporary supply will be non-potable water and have the same restrictions as PID's existing supply.

Installation

The installation and maintenance requirements include:

1. Complete meter recovery at the temporary supply location
2. Sample temporary supply source service lateral
    a. A negative sample result will allow for temporary supply connection
3. Install hose over line between service and supply connection
    a. Primary connection made at sample manifold assembly
    b. Secondary connection points to customer will be considered
    c. Install backflow preventing check valve on hose-over connection
4. Install orange construction fencing along the length of the line so construction and debris removal crews are aware of its location.
5. Notify customer of installation pathway and advise them to be cognizant of its status
6. Remove and salvage equipment following sampling sequence completion
7. Reconnect customer to original service connection by opening customer isolation valve.

Procurement

PID will purchase about 3000 feet of NSF61 certified hose material, which accounts for 100 300' segments. The use of NSF61 material makes the hoses available for future use for hose over connections for potable supply. A general contractor will be hired to manage the installation of the hose connections and will also provide daily observation of the hose status. If a hose connection is damaged, the customer will be notified, the supply will be terminated, and the connection will be replaced. The contractor will be responsible for managing the installations, disconnection, and maintenance of the hose-over connections.

On-Site Temporary Supply

Those customers not able to be supplied by an adjacent lateral will be provided with on-site temporary supply. Storage volume on-site accounts for indoor use patterns only, as the duration of the temporary supply is limited to the sampling timeframe - estimated to be one week. The supply equipment package as shown in Figure 1 includes:

- storage tank for a week's worth of single service supply (1000 gallons)
    - customers on isolated mains will have a larger storage capacity (approximately 3,000 gal) and the tanks will be ground mounted
- booster pump to pressurize water from storage to service
- pressure tank for reliable pressure supply to customer.

The package will be delivered in an enclosed flatbed trailer to deter vandalism. The pump discharge will be connected to the sample manifold connection point provided in the meter recovery process. The power supply will be provided by the customer's local electrical panel. The temporary water supply will be non-potable water with the limited contact order.

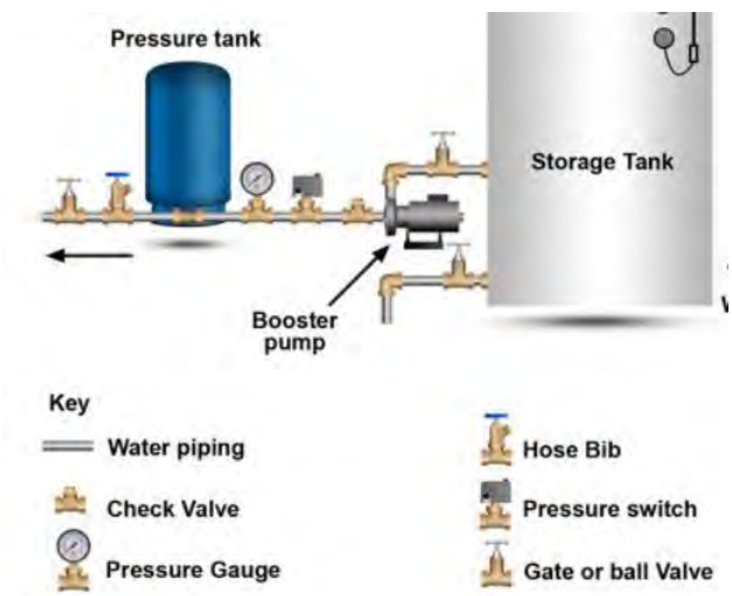

Figure 1: Temporary Supply Package

Installation

The installation and maintenance requirements include:

1. Complete meter recovery at temporary supply location
2. Deliver temporary supply package
3. Connect pump discharge from supply to service
    a. Connection will include backflow prevention
4. Connect pump station to customer electrical service panel
5. Startup system
6. Remove and salvage equipment following sampling sequence completion
7. Reconnect customer to original service connection by opening customer isolation valve.

Procurement

PID will provide a booster pump skid package design. A general contractor will be hired to source the equipment and build the temporary pump skids, manage the implementation, maintenance, removal and transfer of the temporary packages. PID will determine which services which will be provided temporary supply packages in accordance with recovery and sampling efforts and main isolation.

Meetings/Reports

Contractor shall attend weekly meetings with PID staff and other action leaders to update PID on the progress of temporary supply installations and discuss other action issues and solutions. Additionally, the Contractor shall provide daily and weekly reports of progress and issues encountered. The reports shall include, but not be limited to, progress report, overall action schedule, problems encountered, and conflicts with other actions.

Our water.
Our future.
Paradise Irrigation District

Paradise Irrigation District
Water System Recovery Plan
Water Meter Recovery – Justification Report

Date: April 12, 2019
Prepared by: Sheila Magladry, P.E.
Checked by: Michael Lindquist, P.E.

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Damage Description

Many of PID's services and appurtenances were destroyed by the Camp Fire and/or fire-fighting activities, whether by melting caused by excessive heat or damage by physical impacts related to debris removal or traffic. Some assemblies may be obviously damaged: the meter housing may appear melted or broken to the naked eye. Others may appear to be undamaged, but only upon further testing can it be determined the interior function of the meter is operable and uncontaminated. A complete understanding of service and meter status throughout the town must be made clear to facilitate system repair.

Action Purpose

The scope of this action will be to locate and evaluate damage to all meter boxes and meter assemblies in the system. Those items which are destroyed or damaged must be identified for repair or replacement. This entire process must be meticulously recorded and reported.

Meter box types include concrete and plastic boxes, and steel, concrete, and plastic lids. Each meter box will be evaluated and identified as damaged or serviceable as part of the recovery action. Meter box replacement/repair description and costs are covered in a different action.

The original PID meters were primarily plastic body Badger Recordall positive displacement meters with Datamatic System automatic meter readers (AMR). The AMR infrastructure is made up of collectors, enhanced repeaters, and repeaters. The meters are equipped with a Meter Interface Unit (MIU). The MIU consists of an electronic component that collects data from the meter register and transmits that data to the repeater and collection components. The MIU body is made of plastic and houses the electronic circuitry as well as two lithium batteries. At the time of the fire, PID was in the process of transitioning to Zenner PPD brass meters with the Zenner Stealth automatic reader system. Approximately 75% of the system is still the Badger meter style. It is likely the Badger meters were more susceptible to damage during the fire than the Zenner meters as the plastic body could have melted or introduced contaminants into the service. The MUI components were likely damaged as well as the housing for that instrument was also plastic. The Zenner meters are on average 50% the cost of a new Badger meter. The Zenner meter is the preferred replacement item as it is less prone to damage due to the housing material and is less costly to replace. The replacement costs will be assumed using the Zenner replacement alternative.

The presented alternatives will compare the costs to inspect, repair, and/or replace meters. For consideration, the average cost to inspect, repair, or replace a meter are included in Table 1.

Table 1: Average Unit Costs

Unit Cost to Inspect	Unit Cost to Repair[1]	Unit Cost to Replace[2]
$45	$80	$95

[1] Repair costs assume repairing with Badger repair parts
[2] Replacement costs assume Zenner meter type replacements

The initial estimates shown are for providing inspection, repair/replacement for 13% of the system (the current number of occupiable structures plus 20% rebuild). This data point addresses the decrease in services in the system driven by the mass ex-migration. No undamaged meters will be labeled for reinstallation in this initial 13% phase. Cost estimates assume all meters in this initial batch will either be replaced or repaired. All undamaged meters can be saved for future reinstallation at other locations.

For the final alternative comparison, it is assumed 100% of the meters in the system must be recovered and inspected for damage or contamination in order to be cleared for reinstallation. The cost of repair/replacement varies depending on how many of the meters are determined damaged. A sensitivity analysis is presented to show how this total cost varies according to percent system damage.

Alternative 1: Recover, Inspect, and Repair/Replace

Scope

This alternative involves locating, removing, and inspecting every meter assembly for functionality and contamination. If a meter assembly is acceptable, it can be labeled for reinstallation. If it is damaged but repairable, the unit can be repaired and labeled for reinstallation. If the unit is damaged and unrepairable, it will be labeled and sorted for disposal. If the unit is contaminated, it will be labeled damaged and sorted for disposal. All damaged meters beyond repair will be replaced with Zenner meters. Repaired meters will be repaired with Badger repair parts.

Alternative 2: Recover, Inspect, and Replace Damaged

Scope

This alternative also involves locating, removing, and testing every meter assembly for functionality and contamination. If a meter assembly is acceptable, it can be labeled for reinstallation. If it is damaged or contaminated, whether repairable or not, the unit will be labeled as damaged and sorted for disposal. All damaged meters will be replaced with Zenner meters.

Alternative 3: Recover and Replace All

Scope

It may be more cost effective and time efficient to collect and replace all meter assemblies, regardless of functionality or contamination. Alternative 3 will locate, record visual status of the meter assembly, and remove all meters. Costs will be assumed for 100% system replacement with Zenner meters. All existing meter assemblies will be disposed.

Recover Process

13% System Recovery

The alternatives are presented to compare estimated costs and implementation time to recover and investigate 13% of the system. The cost of alternative 3 is 20% the cost of alternatives 1 and 2 and provides the quickest recovery period. Initially, it is most time and cost efficient to collect and replace meters without inspection or repair.

Table 2: 13% System Recovery

Alternative	Estimated Cost	Estimated Schedule
Alt 1: Inspect, Repair/Replace[3]	$1,100,000	92 days
Alt 2: Inspect, Replace	$1,150,000	88 days
Alt 3: Replace All	$910,000 (20% savings)	20 days
Assumptions		
Recovery and Reinstallation Crew	10	People
Inspection and Repair Crew	5	People
Number of Supervisors	4	People
Overhead	20%	percent

100% System Recovery

Without thorough recovery and inspection efforts, it is impossible to know the extent of contamination and damage to the system. A sensitivity analysis was performed to show the cost and schedule increase related to percent of system damaged. The same assumptions apply to the 100% system recovery as applied to the 13% system recovery.

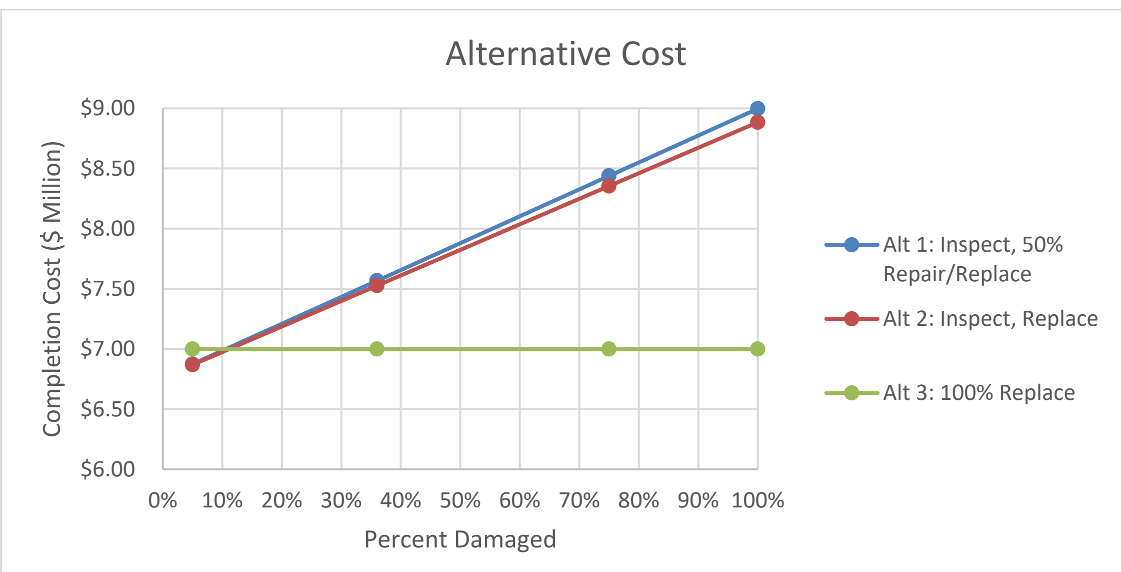

Figure 1: Sensitivity Analysis for Alternative Cost

[3] Estimate assumes 50% of damaged meters can be repaired and 50% require replacement

Figure 1 shows the relationship between cost and percent damaged for each alternative. Alternative 3 is approximately the same cost as the other two alternatives at 12% damage. However, as the percent damage increases, the other two alternative costs increase due to the volume of repair or replacement costs coupled with inspection costs. Once 3% of the system is determined damaged (340 meters), it is most cost efficient to continue with a full system replacement. This will cap the action cost at $7 Million. The time estimated to complete the 100% system recovery with 3% inspections is 172 days.

Selected Alternative

The selected alternative is a combination of the presented alternatives. As the meter recovery process begins, the meters will be inspected and tested for damage. Once a damage threshold is reached (recommended threshold is 340 meters) no more meters will be inspected, and the district will proceed with replacing the remaining meters. This will allow for an initial assessment of meter damage but will contain the action cost if the number of damaged meters is excessive (more than 3% damage).

Our water. Our future.
Paradise Irrigation District

Paradise Irrigation District
Water System Recovery Plan
Appurtenance Recovery – Justification Report

Date: April 9, 2019
Prepared by: Sheila Magladry, P.E.
Checked by: Michael Lindquist, P.E.

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Damage Description

The extent of damage to the water system due to the Camp Fire is unknown. It has been discovered that many of the services and appurtenances were destroyed by the fire and/or fire-fighting activities, whether through excessive heat causing melting or damage by physical impacts related to debris removal or traffic. A complete understanding of appurtenance status is required to ensure PID can safely and reliably provide potable water.

Appurtenances include:

1. Fire Hydrants
2. Blow Off Assemblies
3. Air and/or Vacuum Release Valves
4. Pressure Reducing or Regulating Valves
5. Other Service and Control Valves

Action Purpose

The scope of this action will be to locate and assess damage to all appurtenances in the system. Those items which are destroyed or damaged must be identified for repair or replacement. This entire process must be meticulously tracked.

Alternative 1: Recover, Inspect, Test and Replace

Scope

It is likely many appurtenances were obviously damaged, and they may have already received repair or replacement. Other items may appear to be operable but may contain contaminants. The only way to ensure all appurtenances are safe to operate within the system is to locate, inspect, test, and if required repair each appurtenance in the system. Alternative 1 method of completion is:

1. Locate and identify every appurtenance that existed in the system prior to the fire
2. Note the status of the appurtenance
3. Inspect for damage
    a. Visual damage inspection
    b. Some appurtenances may require bench-top inspection for operation
    c. Sample appurtenance for contamination
        i. Sampling will be completed as part of the Sampling Action
4. Reinstall undamaged appurtenance as required
5. Replace damaged appurtenances
6. Dispose of damaged appurtenances

Estimated Cost

Preliminary estimates assume approximately 30% of appurtenances are damaged.

Estimated Schedule

The schedule to locate, inspect, and test every appurtenance in the system was created using 10 crews of 5 inspectors.

Alternative 2: Recover and Replace

Scope

For discussion purposes, a full system replacement without testing and repair was considered. This scope still requires locating and identifying all appurtenances, but inspection and testing for contamination is not required as all appurtenances assume replacement.

Estimated Cost

Preliminary estimates assume 100% appurtenance replacement.

Estimated Schedule

The schedule to locate and replace every appurtenance in the system was created using 10 crews of 5 inspectors.

Alternative Selection

Table 1 summarizes the two alternatives and their associated cost and schedule estimates. Alternative 1 is much more favorable in both categories, so it is the recommended solution. The appurtenances will all be inspected before they are labeled for repair/replacement or reinstallation.

Table 1: Alternative Comparison

Alternative	Alt 1: Recover, Inspect, Test, and Replace	Alt 2: Recover and Replace
Estimated Cost	$5.7 Million	$17 Million
Estimated Schedule	6 months	11 months

Paradise Irrigation District
Water System Recovery Plan
Asset Recovery – Implementation Plan

Date: April 12, 2019
Prepared by: Sheila Magladry, P.E.
Checked by: Michael Lindquist, P.E.

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List of Acronyms

Acronym	Description
ARA	Asset Recovery Application
ID	Identification Number
PID	Paradise Irrigation District
PRV	Pressure Regulating Valve
RA	Recovery Artist

Action Description

The scope of this action will be to locate and evaluate damage to all meter assemblies and appurtenances in the system. All appurtenances must be inspected for damage and contamination and identified for repair or replacement as required. The meters must be inspected for damage, either operational or contamination, up to a total of 340 meters (or another number as determined by the district). At this point the remaining meters will be replaced. Is it more cost effective for the action to continue with meter replacement after this portion of the system is confirmed damaged, than to continue with inspections.

The entire recovery process must be meticulously recorded and reported. Every asset, meter or appurtenance, will be assigned a unique identification number. The number will be logged in the GIS application, and will also be physically attached to the asset using a metal tag. All data gathered during the recovery process will be logged in a GIS database. The data will be collected in a collector application (app) database which will be referenced for presentation on the GIS map.

Debris removal crews require water for dust control, so they cannot be onsite while the service is being stagnated for sampling. Additionally, they may damage the sample manifold, as it will likely protrude above grade. The recovery action will attempt to follow the debris removal crews as best as possible.

Collector Application

The Asset Recovery App (ARA) will include the following data entries:

1. Asset selection
    a. Meter
        i. Meter
        ii. Curb stop
        iii. Customer shut-off valve
        iv. Meter box
    b. Appurtenance
        i. Fire Hydrants
        ii. Blow Off Assemblies
        iii. Air and/or Vacuum Release Valves
        iv. Pressure Reducing or Regulating Valves
        v. Other Service and Control Valves
2. Asset location (as currently identified in PID system database)
    a. If the mapped location differs from the actual location, the recovery artist will be able to confirm the location by "pinning" his location while standing at the asset.
    b. The asset location information will be assigned to the specific PID identification number associated to that asset.
3. Photo verification of asset and related items
    a. The app will allow for multiple photo entries.
    b. If the asset or related assembly items are excessively damaged, multiple photos may be necessary to record the damage.

4. Notes
    a. If the recovery artist notes any additional useful information this portion of the app will track that information
5. Sample Ready
    a. Yes or No
    b. If No, notes why
6. Damage Assessment
    a. Visual Damage
    b. Mechanical Damage
        i. Will be determined for appurtenances following testing
    c. Contamination
        i. Will be determined for appurtenances following testing
7. Repaired (Y/N)
8. Replaced (Y/N)
9. Reinstalled (Y/N)

Asset Recovery

Prior to meter recovery, there will be efforts made to locate all meters. PID will attempt to locate and mark all meter locations. The mains and (where practical) service connections to the mains will be located using Underground Service Alert (USA).

Every asset, meter and appurtenance in the system must be located, identified, and recorded by a recovery artist. The recovery artist (RA) will follow this process:

1. Be provided an asset recovery map provided by the Asset Recovery Artist Supervisor identifying recovery location and appurtenance ID numbers
2. Asset location
    a. RA will locate the asset using the ARA
    b. RA will update the location information if necessary
3. Asset identification
    a. Every asset will be assigned a unique identifier number. In cases where the existing asset number (meter ID for example) can be associated with a location or address, this will be used as the unique number. If an asset ID number does not already exist, one will be created and attached to the asset account.
    b. A tag with the unique asset ID number will be physically attached to the asset (only for appurtenances) and the field connection location.
4. Asset documentation
    a. Photos
    b. Additional notes as required
    c. If applicable, complete damage assessment. This will only be completed by the RA if visual damage is apparent.
5. Asset removal

a. Appurtenance
    i. Appurtenance Removal will be determined by PID staff. This must be closely monitored to not disrupt service or cause safety issues.
b. Meter - All meters will be removed
    i. Close the curb stop.
    ii. Close the customer supply valve
    iii. Remove the meter assembly
    iv. Install sample manifold assembly
    v. Reinitiate non-potable water service as determined by PID
        1. Non-potable service will not be metered.
    vi. Cap Sample manifold, or close valves as appropriate for all other locations

6. Flushing of service lateral
    a. AR shall bleed all air out of the service lateral and flush a minimum of 2 volumes of water (typically about 3 gallons) from the pipe through the larger sample port on the sample manifold.
    b. The flushing water will be collected and disposed in a specified location
7. Asset marking
    a. Install the unique asset ID tag
    b. Mark the location with a 1”-2” dot of yellow paint to provide a visual indication that the asset has been completed

Every meter will be replaced with a sample manifold to prepare the site for sampling. In some locations, excavations of the meter box may be required to complete the plumbing of the sample manifold.

Procurement

The speed of the recovery program will be limited by the density of resources used for the action. There will be a team of approximately 20 recovery artists (RA) working full time with a recovery rate of 4 assets per day per RA to complete the recovery process for every asset in the system. PID will provide directions and priorities to the recovery artist team. The meter recovery artists will be either PID staff, inter-agency volunteers, or a contracted entity. Appurtenances will be recovered by PID operations staff as taking these items offline has a greater impact on the system compared to meter recovery. Lab technicians will include PID staff as available, interagency volunteers and additional contractors.

Meetings/Reports

Contractor shall attend weekly meetings with PID staff and other action leaders to update on the progress of recovery operations and discuss other action issues and solutions. Additionally, the Contractor shall provide daily and weekly reports of progress and issues encountered. The reports shall include, but not be limited to, progress report, overall action schedule, problems encountered, and conflicts with other actions.

Recovery Specifics

Sample Manifold for Meter Recovery

The sample manifold will be installed in lieu of the meter assembly until the replacement meter can be installed. The sample manifold installed will depend on the status of the structure the meter serves. The sample manifold will have two pipe connections: one for sampling with a ¼" sample tap and a ½" flushing connection, and a ¾" connection for temporary supply. The connection sizes vary between 5/8" and 2", so the sample manifolds will be custom fabricated from galvanized steel pipe with brass fittings depending on the connection size. See the diagram in Figure 1.

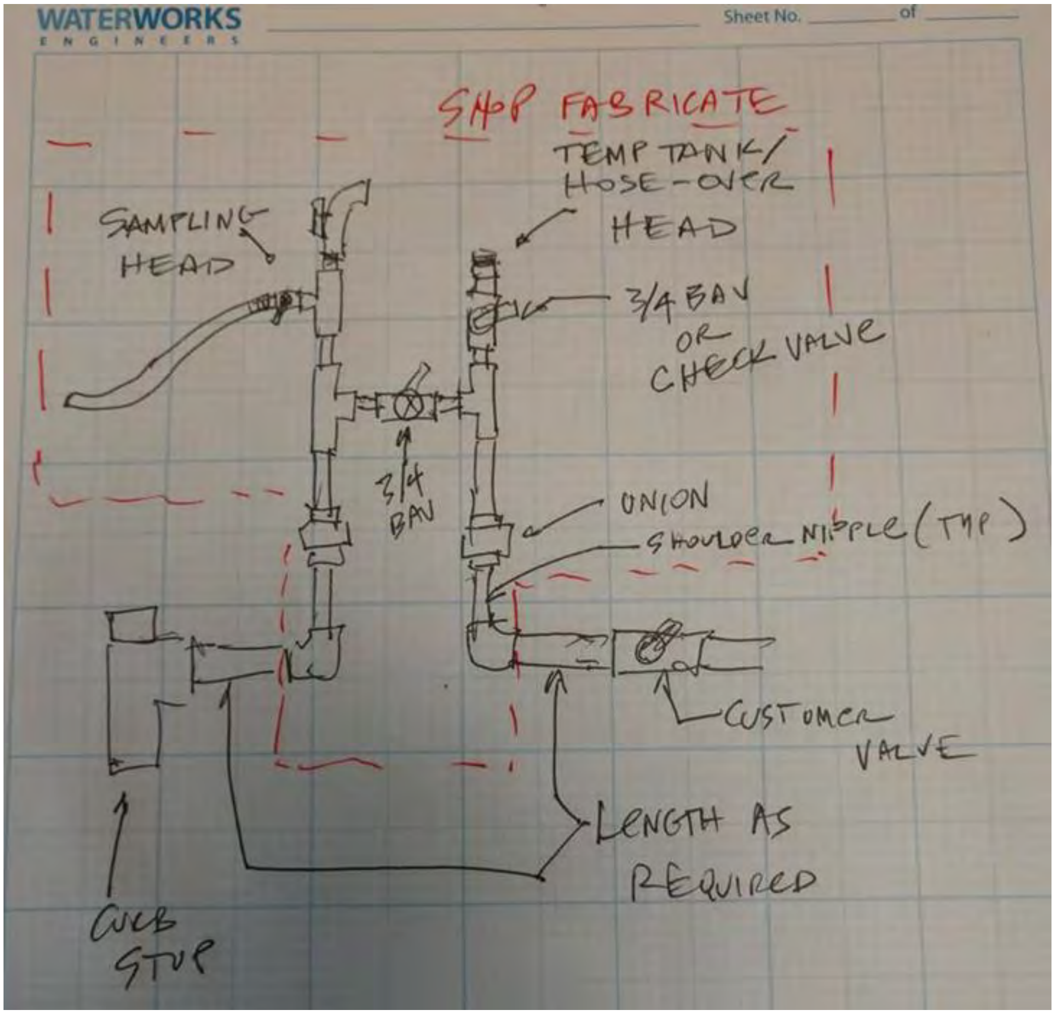

Figure 1: Sample Manifold Detail

Functionality Testing

The recovered assets require functional bench testing. There are integral mechanical items within the assets that cannot be proven to be functioning properly in the field. All valves including stops will be visually tested for leakage in the field.

Contamination Testing

All assets must be sampled and tested for contamination. Hydrants will be field sampled. Other assets will be sampled in the field or laboratory (the type of test will be determined by the physical condition of the asset, and the likelihood of contamination). For lab testing, the asset will be submerged in potable water for 72 hours, and a representative sample will be taken from the submergence water following the submergence period. If the sample result is positive, the associated asset will be marked for disposal.

Disposal

All discarded assets will be strategically sorted for disposal. The meters and lithium ion batteries are considered electronic waste. The meter housing must be separated from the battery prior to disposal. The discarded appurtenances will be sorted by material. Plastic and metal materials can be recycled. Other materials may be repurposed for use in non-potable applications.

Table 1: Typical Disposal Costs

Item	Cost
Meter Housing	$0.25/lb
Lithium Ion Batteries	$12/lb
Plastic and Metal	Possible salvage value

Asset Repair

The action justification report concluded it is more cost effective and time efficient to replace all damaged meters assuming 3% of system damage. Damaged meters will not be repaired. Damaged appurtenances will be repaired where possible. The repair will either be conducted by PID staff or sent to repair shops.

Data Mapping

The collected data, including asset recovery and sampling results, will be stored and presented on the GIS map.

Paradise Irrigation District
Water System Recovery Plan
Sample Mains, Services, and Appurtenances – Justification Report

Date: April 12, 2019
Prepared by: Michael Lindquist, P.E.
Checked by: Sheila Magladry, P.E.

Contents

Damage Description

Preliminary sampling efforts of the distribution system following the Camp Fire indicate benzene and other organic contaminants are present at levels above drinking water standards in numerous water services and water mains. Currently, PID is providing non-potable water to services via the damaged distribution system and PID has issued a limited-contact order for all water service locations.

Purpose and Goals of Action

Previous sampling has proven that some components in the system are contaminated with volatile organic compounds (VOCs). The purpose of sampling the system components is to determine conclusively and provide evidence of damage to system components and optimize repairs and replacements.

Sampling results will be used to reduce the potential of cross contamination to currently unimpacted portions of the water distribution system. Sample collection and data analysis will provide the information required to properly isolate unimpacted portions of the distribution system from contaminated components and portions of the system.

The action must be able to readily be contracted out to facilitate the commencement of the sampling action and data collection. All system components must be accurately and completely characterized. All occupiable residential structures and essential service facilities must be sampled within 12 weeks, and the rest of system shall be completed within 36 weeks. All samples must be collected and processed consistent with State and Federal requirements.

Scope of Action

This action is intended to sample service laterals, water mains, and appurtenances (hydrants, blow-offs, air release valves, and pressure regulating valves). It does NOT sample customer service lines or a structure's plumbing.

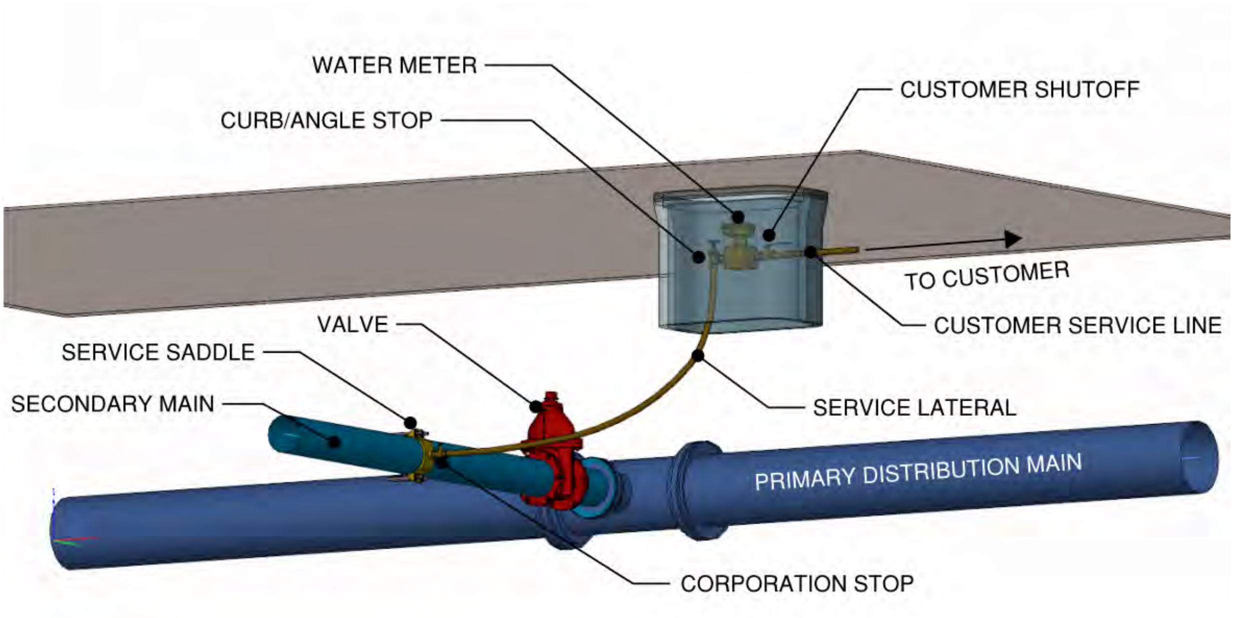

Figure 1: Schematic of Customer Connection to Distribution Main

Action Alternatives

Alternative 1: Entire System Sampling

Scope

The Entire System Sampling Alternative will sample approximately at approximately 16,000 individual points throughout the system. The points include water mains (3600 points), service laterals (10,600 points), and appurtenances (hydrants, blow offs, pressure relief valves, and air release valves – 1800 points). Because of retesting and verifications, the total amount of samples/test for this action will be approximately 20,000.

The sampling includes drawing a water sample from each service lateral and sampling the main primarily through a second water draw on selected service laterals. The samples will be collected, organized and tested. The samples will be tested for the full suite of VOCs. The results will be compiled in a GIS database.

The sampling staff will utilize a tablet-based application to input location, condition, and sample meta-data (date/time, lateral/main, and any relevant notes).

Retesting at select points will be performed to verify results and verify that contamination does not reoccur in the system.

Estimated Cost

Initial sampling of entire system (approximately 20,000 samples)	$8,300,000
For 16 additional months of sample/testing (3200 samples)	$1,400,000
Total for initial and 16 months additional testing	$9,700,000

Estimated Schedule

The goal is to sample/test approximately 4000 points which include all occupiable residential structure service lines and water mains/appurtenances serving occupied areas within 12 weeks of the notice to proceed (NTP); The remaining points sampled/tested within 36 weeks of the NTP. Monthly monitoring is expected to continue for an additional 16-20 months.

Alternative 2: Benzene Only Testing

Scope

Fundamentally the same as Alternative 1, except Alternative 2 will test for only benzene. Currently, there is no conclusive evidence that benzene is an accurate surrogate for other contaminants within the system[1].

Estimated Cost

Initial sampling of system (approximately 20,000 samples)	$5,500,000
For 16 additional months of sample/testing (3200 samples)	$1,000,000
Total for initial and 16 months additional testing	$6,500,000

Estimated Schedule

The goal is to sample/test approximately 4000 points which include all occupiable residential structure service lines and water mains/appurtenances serving occupied areas within 12 weeks of the notice to proceed (NTP); The remaining points sampled/tested within 36 weeks of the NTP. Monthly monitoring is expected to continue for an additional 16-20 months.

Alternative 3: Partial System Sampling

Scope

Fundamentally the same as Alternative 1, except this action would sample selected components (mains, service lines, and appurtenances) with the intent of extrapolating the results to the entire system. The system may be characterized by choosing approximately 3000 points to sample (16% of the system). Based on the results, the action would more thoroughly sample areas returned positive contamination results. This alternative estimates 50% of the system components would be sampled (approximately 9000 points) upon action completion.

[1] Onsite Visit Response and Recovery Observations Presented to PID February 13, 2019, Andrew J. Whelton, Ph.D., et. al., February 2019

If this alternative is selected, the only method to conclude that all components are not damaged is through extrapolation. It does not provide testing of all service laterals.

Estimated Cost

If approximately 9000 points in the system components are sampled:

Initial sampling of system (approximately 9,000 points)	$4,100,000
For 16 additional months of sample/testing (3200 samples)	$1,400,000
Total for initial and 16 months additional testing	$5,500,000

Estimated Schedule

The goal would be to complete all initial sampling within 24 weeks of the notice to proceed. Monthly monitoring is expected to continue for an additional 16-20 months.

Action Goals

The alternatives meet the following action goals:

Goal	Alterative 1 Entire System Sampling	Alternative 2 Benzene Only Testing	Alternative 3 Partial System Sampling
Readily Initiated	Yes	Yes	Yes
Complete characterization of system	Yes	No	No
Sample occupiable residential, mains serving occupied areas, and essential services structures within 12 weeks	Yes	Yes	Yes
Sample all components within 36 weeks months	Yes	Yes	Yes
Sampling and Testing consistent with CA DDW and US EPA	Yes	Maybe	Yes
Estimated Cost	$9.7M	$6.5M	$5.5M

Selected Alternative

The preferred alternative is Alternative 1: Entire System Sampling. Testing for the full suite of VOCs at all lateral services, water mains, and appurtenances will provide the most conclusive evidence that the system can meet potable water standards and customers can confidently reconnect and receive potable water. It also provides the most accurate assessment of damage so repairs and replacements can be optimized.

Alternative 2 was not chosen because benzene is not an accurate surrogate for all the contaminants in the system. Testing for benzene only does not allow a final determination that the system meets potable water requirements.

Alternative 3 was not chosen because partial sampling makes it extremely difficult to declare the entire system ready for serving potable water to customers and it does not provide an accurate assessment of damaged components that need to be repaired or replaced.

Paradise Irrigation District
Water System Recovery Plan
Sample Mains, Services, and Appurtenances – Implementation Plan

Date: April 12, 2019
Prepared by: Michael Lindquist, P.E.
Checked by: Sheila Magladry, P.E.

Contents

Action Description

The scope of this action will be to sample and test approximately 18,000 points throughout the PID system. This entire process must be meticulously tracked and recorded. The recovery process will use GIS mapping to log the sample and test results data. The sample data will be collected in a collector application (app) database which will be referenced for presentation on the GIS map.

Recommended Action

The action will sample approximately 18,200 individual points throughout the system. The points include water mains (3600 points), customer service lines (10,600 points), and appurtenances (hydrants, blow offs, pressure relief valves, and air release valves – 4,000 points). Some points will be sampled multiple times to verify results and confirm areas have not remain free of contamination over time.

The action will be responsible for:

Sampling and Analysis Plan (SAP) – PID will provide the Contractor with priorities of sampling, such as occupiable residential structures and essential service facilities first, followed by unoccupied areas. The Contactor shall create an efficient Sampling and Analysis Plan (SAP). The SAP will include a Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The FSP shall be used for daily and weekly dispatching of sample staff and organization of samples and testing. The QAPP will include quality control of both field and laboratory work. The QAP shall specify MDL/RL requirements, QA duplicate sample policy, and provisions for retesting because of suspect results (e.g. verifying/correcting potentially errant results). The SAP will be revaluated at 1 week, 1 month, and bi-monthly for the remainder of the Action. The revaluation shall make modifications to increase efficiency and correct common errors.

On-call sampling – During the action duration, the contractor shall be available to sample specific single points (not to exceed 10 on any given weekday) that are not part of the sampling plan as directed by PID. On-call sampling shall not interfere with the Sampling Plan provided by the Contractor. On-call samples shall be sampled within 2 working days of the request.

Monthly Monitoring – After the sampling of the approximately 18,200 points, the Contractor shall be available to sample up to 300 points per month (maximum of 14 per day) for an additional 12-18 months.

Standard Operating Procedures (SOP) – Contractor shall develop SOPs for dispatching staff, collecting samples, transporting samples, and data entry into the program database. SOPs shall include a section for "what to do" for exceptions that are not covered in the SOP (e.g. a sample cannot be collected because a service was not properly recovered).

Sampling – Sampling shall be accomplished by qualified staff following proper protocols. Samples will include chain of custody. A majority of tests will be for a full volatile organic compound (VOC) suite to provide confidence that the system components meets all potable requirements related to VOCs. Benzene only tests may be used for some system components if it is determined that full VOC is not needed (based on conclusive data that benzene is an accurate surrogate). The type of tests may be modified as more

data is collected and analyzed. Every service lateral will be tested. Mains will generally be tested through service laterals. Service laterals will have been prepared for sampling and flushing during the Asset Recovery Action.

Organize and Transport Samples - Samples shall be organized for delivery to specific labs. To meet milestones, multiple labs will need to be utilized. To ensure accountability of maintaining testing schedules, the Contractor shall be responsible for transportation of samples to laboratories.

Coordinate with Other Actions – Sampling must be coordinated with PID system operations and other recovery actions. A component cannot be sampled until it is recovered by the Asset Recoverya. System operations will affect movement of the water in the system and must be accounted for in the sampling of some components. Coordination with the Temporary Customer Supply Action is required for occupiable structures so that the temporary water supply is in-place 72-hours prior to the sampling event to achieve the “stagnation period.” Resampling of areas and components may be required after repairs/replacements have been completed.

Populate the GIS database – The GIS database will be the central depository of data for all actions. The Contractor shall be responsible for populating the database with sampling and results data. The Contractor shall ensure that laboratories adhere to the database Electronic Data Delivery (EDD) requirements (to be established by PID)

Reporting – The Contractor shall provide daily and weekly reports of progress and issues encountered. The reports shall include, but not be limited to, number of samples taken, percent complete, summary of test results, sampling/testing problems encountered, conflicts with other actions, and lab testing turn-around times.

Worker Safety – The sampling will occur in rural areas that may have fire-related debris; extensive construction projects are occurring throughout the area. Workers shall have training regarding recognizing hazards and protecting themselves. Additionally, all sample staff shall be Hazardous Waste Operations and Emergency Response (HAZWOPER) certified (appropriate level for the hazards expected). Contractor is responsible for providing personal training and protective equipment (PPE) for their staff. Minimum PPE is Class 2 high visibility vest, closed toe shoes, ANSI Z87.1 safety glasses, and nitrile surgical-style gloves for sample handling.

Equipment and Supplies – Transportation, personal protective equipment (PPE), staff management, and all other items needed for the successful completion of the scope of services shall be provided by the Contractor. PID anticipates it will provide a half-time staff liaison to coordinate the Contractor’s work and PID Operations.

Sample Water Flushing – Contractor shall comply with State and Federal water-discharge requirements when sampling. Any water not collected in sampling containers must be captured and deposited in at the Flushing Water Collection Site (likely a central depository tank located at Reservoir B Site). Water containing contaminants will be treated and disposed of properly.

Laboratory Contracts - An important constraint on the sampling/testing is the capacity of regional laboratories. Based on PID pre-action contact with laboratories in Northern California, if five testing laboratories are used concurrently, approximately 120 samples per day can be tested (5 days per week). The Contractor shall be responsible for maximizing the use of available laboratory capacity and minimizing testing costs. Additionally, establishing formatting of results data for seamless integration into the program database tool(s) is important. Organizing the particular sampling methods and equipment for each laboratory shall be the responsibility of the Sampling Contractor.

Temporary Facilities - The Sample Contractor shall provide their own temporary office and storage space for the duration of the action. PID can accommodate up to one 8x32 foot trailer with electric, water, and sewer hookup at the PID main office or water plant site.

Collector Application - Each Sample Team shall be equipped with a tablet containing the Collector App (sampling data collection software application). The application will seamlessly upload the data to the program database when connected via wi-fi or cellular. The application will be developed as part of a separate action. The Collector App will be in addition to any other necessary data recordation necessary by DDW or a particular laboratory.

Sample and Analysis Progression

PID shall develop the priority of sampling locations. The sampling locations will be determined and coordinated using the GIS database. The first sampling priority will be mains serving areas that contain active meters and service laterals at occupiable structures. Sampling will generally move from Zone A down the system to Zone G. After occupiable structures are sampled, the action will move to remaining services and mains.

The SAP will be revaluated at 1 week, 1 month, and bi monthly for the remainder of the action. The revaluation shall make modifications to increase efficiency and correct common errors.

Sampling Service Laterals and Mains

Samples of the service lateral shall accurately characterize the water quality within the service lateral pipe. Samples shall be taken by purging water until a sample is obtained that is between the meter and the mid-point of the service lateral (mid-point is midway between the water meter and the water main). The purge volume prior to sample is a function of the length and diameter of the service lateral. Generally, approximately 16 ounces of water shall be gently purged prior to taking the sample.

Air-purging prior to sampling may be required. Any water purged during air-purging is part of the purge volume.

Samples of the water main taken through a service lateral pipe shall include flushing the service lateral, so the sample accurately reflects the water in the main. Flushing velocity through the service lateral shall be at least 3 feet per second and greater than 2 volumes of the service lateral pip. The goal is to vigorously flush the water through the service lateral to ensure that sample accurately characterizes the main. Generally, the flushing volume will be at least 5 gallons of water in 2 minutes or less.

Samples shall have a chain of custody to ensure accuracy.

Sampling shall be consistent with each testing laboratory's specific instructions.

After sampling, each site shall be tagged with a waterproof wire tag to provide physical evidence that the point has been sampled. The tag shall include the sample location number, type of sample (lateral or main) and date and time of sample. Example tag.

Figure 1: Sample Tag Example

Sampling Appurtenances

Sampling fire hydrants and blow offs requires additional field work because the sample point will not be prepped for sampling. Sample staff shall receive special instruction for sampling appurtenances.

Generally, fire hydrant samples are intended to characterize the water within the hydrant itself. Sample discharge should not exceed the volume of the hydrant (typically less than 3 gallons).

If mains are sampled through a hydrant, sufficient water must be flushed through the hydrant and 6-inch service pipe.

Generally, blow-off samples are meant to characterize the water within the blow-off assembly but may also be used to characterize the main.

Action Coordination

The sampling shall generally follow the Asset Recovery Action which will have prepped the service lateral sampling sites.

The service lateral must be stagnant for a minimum of 72-hours prior to being sampled. It is the responsibility of the Sample Contractor to schedule sampling that allows for adequate stagnation time. The date/time of a service lateral's recovery, and hence availability for sampling, will be available in the GIS database.

Stagnation time for each service lateral shall be reported (the difference between service recovery date/time and sample date/time) and recorded in the results database.

Special Coordination for Occupiable Structures

It is the intent of the Temporary Customer Supply to minimize the disruption to connected customers. When occupied structures are tested, the structure shall be equipped with a temporary water source, either a hose-over or a temporary tank.

Hose-overs will temporarily connect a nearby service lateral connection to the occupied structures service line downstream of the meter. Prior to connection, the temporary service lateral <u>must</u> be tested and the results

indicate it is free of contamination. The sampling and testing must be scheduled well in advance to allow completion prior to preparing the occupied structure for testing - likely a minimum of 15 working days earlier.

Once the test of the temporary connection service lateral shows no contamination, the Sample Contractor shall communicate an “intent to sample an occupied structure” to the Temporary Customer Supply team at least 6 working days in advance of sampling. The lead time allows the Temporary Customer Supply Team to disconnect the structure from the PID system and connect to a temporary water source at least 72-hours prior to the sampling to provide adequate stagnation time of the service lateral pipe. Once the sample is taken, the Temporary Customer Supply Team shall be notified so they can reconnect the structure to the PID system and remove the temporary water source (if appropriate). This should be completed within a one-week timeframe.

Sample Teams

Sample Teams shall consist of one or more staff members (at the discretion of the Sample Contractor).

The Sampling Contractor shall designate at least one team that is available for special-request sampling as needed.

Sample teams shall be equipped with a vehicle, personal protective equipment (PPE), and sampling equipment.

Sample Water Management

Water purged/flushed from pipes may contain contaminants. Water shall be captured, stored, and properly disposed. Generally, water can be discharged into buckets and transported in the sampling vehicle.

When the volume exceeds 15 gallons, the water shall be flushed to a water storage truck.

Flushing water shall be transferred to the storage/treatment system located at Reservoir B site within 8 hours of being collected (e.g. at least once per work day).

Treatment and disposal will be the responsibility of another action.

Schedule

Sampling Contractor shall provide adequate labor, management, and equipment to meet or exceed the sampling goals shown in the following table:

	Number of Samples		
Week #	**per day**	**per week**	**Cumulative**
1	20	100	100
2	40	200	300
3	60	300	600
4	80	400	1,000
5	110	550	1,550
6	110	550	2,100
Continues every week			
36	110	550	18,600

To prevent the Sampling Action from exceeding the capacity of the Asset Recovery and Temporary Customer Supply Actions, the goals should not be exceeded by more than 20%.

The Sampling Contractor shall remain engaged for follow-up/monitoring sampling for an additional 16 months and be capable of up to 300 samples/tests per month (max 14 per day).

Meetings/Reports

Sample Contractor shall attend weekly meetings with PID staff and other action leaders to update on the progress of sampling and discuss inter-action issues and solutions. Additionally, the Contractor shall provide daily and weekly reports of progress and issues encountered. The reports shall include, but not be limited to, number of samples taken, summary of test results, sampling/testing problems encountered, conflicts with other actions, and lab testing turn-around times.

Typical Schedule

An example schedule of the sampling staff is shown in the following table.

Example schedule for Sample Day Activities (times are working days from sample day)

Day	Supervisor Tasks	Field Tasks
Sample Day (S) minus 7 days	Prepare sampling routes	-
S -6 days	Notify Temporary Water Team of intent to sample occupied structure	-
S -2 days	-	Verify Temporary water is in place
S -1 day	Finalize sampling routes	-
Sample Day	Sample Teams briefed and deployed	Sample points Organize samples for delivery Deliver samples to lab
S +11 days (or less)	Results returned from Laboratory Quality Control of results Populate program database with results	-

Paradise Irrigation District
Water System Recovery Plan
Repair and Replace Damaged System Components – Justification Report

Date: April 9, 2019
Prepared by: Sheila Magladry, P.E.
Checked by: Michael Lindquist, P.E.

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Action Purpose

Extensive recovery and sampling efforts are being implemented to determine the extent of damage to system infrastructure. The recovery action categorizes the system assets which are damaged. The sampling action determines which service laterals and main sections are contaminated and require repair or replacement. The repair and replacement of damaged system components will use the results of the previous two actions to determine the extent of repair or replacement work required to ensure a functional potable water system. Preliminary sampling efforts have returned contamination results of 36% positive, so for estimating purposes, it is assumed 36% of the system networking requires repair or replacement.

Activity 1: Repair or Replace Service Laterals

There are approximately 10,500 service connections in the PID water system consisting of domestic and fire service connections. Service lateral material consists of copper tubing, copper and brass pipe, galvanized and steel pipe, HDPE pipe/tubing and polybutylene (PB) pipe/tubing. Table 1 shows the approximate distribution of service materials throughout the system. The service laterals range in diameter from 5/8" to 2", with 80% of the system having the 5/8" connection, 15% with 1" connection, and the remaining 4% distributed through the ¾", 1 ½" and 2" connection sizes.

Table 1: Existing Service Line Materials

Pipe Material	Number of Services
Polybutylene Piping	200
PVC	180
HDPE Tubing	3200
Copper Tubing	2300
Steel Pipe	4700

Alternative 1: Repair Damaged Service Laterals

Flushing is a method of "repairing" contaminated service laterals. The report titled "Considerations for Decontaminating HDPE service lines by Flushing" estimates the time and flushing volume required to flush contamination from HDPE pipe. The report is specifically geared towards flushing 1" diameter, 50-foot long HDPE service mains to remove up to 100 ppb benzene contamination. It should be noted that this material is not the standard within PID's system, and benzene concentrations have been measured at greater than 100 ppb, and benzene is not the only contaminant. The conclusions of the report are shown in Figure 1.

Table 1. Time in Days Needed PER SERVICE LINE to Decontaminate by Water Flushing, based on the concentration of benzene measured before flushing begins. Flushing is with 2.03 GPM of benzene-free (0.0 ppb) water.

Initial measurement concentration (C_2)	Goal A (never above 0.5 ppb)		Goal B (only exceed 0.5 ppb after 72 hours of stagnation)	
	Continuous	Intermittent (once/72 hrs)	Continuous	Intermittent (once/72 hrs)
100 ppb	286	312	195	240
50 ppb	246	270	156	198
20 ppb	195	213	104	141
10 ppb	155	171	66	99
5 ppb	116	129	33	60
2 ppb	64	74	8	20

Table 2. Volume of Water Flushed in Gallons PER SERVICE LINE to Decontaminate by Water Flushing, based on the concentration of benzene measured before flushing begins. Flushing is with 2.03 GPM of benzene-free (0.0 ppb) water.

Initial measurement concentration (C_2)	Goal A (never above 0.5 ppb)		Goal B (only exceed 0.5 ppb after 72 hours of stagnation)	
	Continuous	Intermittent (once/72 hrs)	Continuous	Intermittent (once/72 hrs)
100 ppb	836,264	206	570,180	158
50 ppb	719,304	178	456,144	131
20 ppb	570,180	141	304,096	93
10 ppb	453,220	113	192,984	65
5 ppb	339,184	85	96,492	40
2 ppb	187,136	49	23,392	13

Figure 1: Flushing Volume Calculations

The median benzene concentration measured to date is 33.1 ppb. Assume the flushing method can be used to repair the 36% of the HDPE services in the system with a concentration of 33.1 ppb, the flushing period for a single service line is **2 years.** This is an impractical length of time for PID to manage flushing sequences throughout the community. It is also an impractical timeframe for users to be without potable water. Additionally, the flushing data is inconclusive for other service lateral materials.

The total estimated cost to provide flushing labor, collection and treatment for 36% of the system is $12.8 Million. This alternative does not address these major factors:

- Benzene concentrations above 100 ppb
- Service laterals that are not HDPE material
- Service laterals that are not 1" or 50' long
- Residual benzene contamination in the flushing water
- Other contaminants embedded in the service lateral pipe wall

As this alternative cannot be applied as a remedy to the entire system, there are major factors that the alternative does not address, and the exorbitant timeframe required to complete this alternative, this alternative is not recommended.

Alternative 2: Replace Damaged Service Laterals

An alternative to flushing the services for repair is to replace the contaminated services. Table 2 estimates the repair costs and schedule for replacing 36% of the entire system with HDPE versus copper service material and compares it to the flushing costs and schedule from Alternative 1.

Table 2: Replacement Alternative Comparison

Alternative	1. Flush Service Lateral	1: Replace Service Lateral	
Service Material	Existing	HDPE	Copper
Probable Construction Cost	$12.8 Million	$11.9 Million	$13.9 Million
Estimated Schedule	flushing each service once every 3 days 2 years	10 crews at 3 services per day 5 months	
Comments	Does not ensure contamination free service lateral upon completion.	New materials are NSF61 certified and contamination free	

Disposal of Damaged Services

The service materials collect from the replacement efforts must be disposed of properly. The materials (plastic and metal) are recyclable materials. The materials may have salvage value. The salvage value for the replaced services are estimated to be about $200,000.

Activity 1: Alternative Selection

The recommended alternative is to replace the damaged service laterals with HDPE piping. This material is relatively simple to install compared to copper and provides the lowest estimated cost. The damaged service laterals likely have salvage value.

Activity 2: Repair and Replace Mains

Water Mains include transmission and distribution mains consisting of many types of material and size. Type of materials for water mains include C-900 PVC, C-905 PVC, Schedule 40 and 80 PVC, Concrete Mortar Lined (CML), Asbestos Cement (ACP), Steel (STL), Cast Iron (CIP), Ductile Iron (DIP) and Galvanized (GALV). Table 3 describes the majority main diameter, material, and length statistics.

Table 3: Majority Main Material and Diameter

Diameter (in)	Miles	Material
2	15	Copper
4	17	Asbestos-Cement Pipe
6	63	
8	38	
12	23	
Remainder (1" – 42")	27	Varies

It is assumed that only 5% of the distribution piping in the system is contaminated. This assumption is supported by preliminary sampling data showing very few main samples with contamination. The cost estimates for main repair or replacement will use the 5% damage assumption.

Alternative 1: Main Flushing

Main flushing will be used as a "litmus test" for positive contamination results. If a main sample result is positive, before that section of main is replaced, the line will be flushed and resampled. Main replacement is a large undertaking; to embark on a replacement action based on one sample result is not recommended.

Assuming 5% of each of the lines identified in Table 3 are contaminated, the total flushing volume required is 900,000 gallons. Where practical, the flushing sequences will be broken up into lengths of 500 feet. Ten trucks will be required to capture the water from the 500' length of 12" diameter pipe flushing. The total number of days required to complete this flushing process is 98. All the flushing water must be collected and treated. Assuming the same collection and treatment costs as Activity 1: Alternative 1, the flushing operation will cost approximately $1.7 Million.

Once flushing is complete, the main segment will be stagnated for 48-hours and sampled again at 250-foot intervals. If the re-sample result is positive, then main will be scheduled for replacement. Temporary supply may be required during this retesting period.

Alternative 2: Main and Appurtenance Replacement

If the sample results following the flushing activity are positive, the contaminated main section will be replaced. Assume half of the mains return positive results on the second sample; this will result in 4-miles of main replacement. The replacement materials will likely be Schedule 80 PVC for small diameter pipe, and PVC C900 or ductile iron for large diameter pipe. The repair estimate for this action is $6.6 Million. The replacement timeline for this portion of the action is 21 weeks.

Summary

The following costs and schedule estimates for the recommended repair action are included in Table 4.

Table 4: Repair Summary

Activity	Estimated Cost	Estimated Schedule
Replace Service Laterals	$11.9 Million	40 weeks
Flush Contaminated Mains	$1.7 Million	20 weeks
Repair Contaminated Mains	$6.6 Million	21 weeks
Total	*$20.2 Million*	*81 weeks or 1.5 years*

Paradise Irrigation District
Water System Recovery Plan
Repair and Replace Damaged System Components – Implementation Plan

Date: April 12, 2019
Prepared by: Sheila Magladry, P.E.
Checked by: Michael Lindquist, P.E.

Contents

Action Summary

The sampling action determines which parts of the distribution system are damaged or contaminated. "Damaged" will be the term used throughout the replace or repair action to indicate physical damage or a level of contamination. When a main sample result shows a contaminant is over the MCL, the main is considered damaged. It is suspected that main contamination may be in the water only, not in the pipe walls, and even limited flushing may eliminate the contamination. Service laterals will be considered damaged if the sample test results are above the detection limit. It is cheaper to replace than to flush service laterals.

Each category of replacement has the following definition for damage:

1. Service Lateral Replacement
    a. Not Damaged – sample test results are non-detect, no physical damage to pipe
    b. Damaged – sample test results are NOT non-detect or physical damage to pipe is observed which makes the asset inoperable
2. Main Flushing and Replacement
    a. Not Damaged – sample test results are below the MCL
    b. Damaged – sample test results are above the MCL or physical damage to pipe is observed which makes the asset inoperable

Service Lateral Replacement

Service laterals with test results above the MCL will be replaced without any attempt at flushing. Service laterals with sample test results above the detection limit will be flushed twice and retested. All service laterals which return a second sample with results above non-detect will be replaced.

The action justification report determined it would be most cost effective to replace all damaged service laterals with HDPE service laterals. The highest priority is to repair and replace contaminated service laterals serving occupiable structures. The repair action will follow the same categorizing method as described in the sampling plan.

Installation

The service lateral repair will be accomplished in the following steps:

1. Close the sample manifold isolation valve
2. Excavate to the service saddle at the main connection
3. Replace the service saddle and corporation stop connected to the damaged service.
4. Close the corporation stops on the service lateral
5. Install the new service lateral
    a. Couple the new service lateral to the existing lateral just upstream of the curb stop.
    b. Pull the new lateral into place using the damaged lateral
6. Connect the new lateral to the corporation stop
7. Perform leak test
8. Open corporation stop
9. Backfill and repair paving and sidewalk

Temporary supply will not be needed during the service lateral replacement. The replacement should be completed within 8 hours maximum. It is acceptable for a customer to be without service for one 8-hour period.

Procurement

The service lateral replacement action will be completed by a general contractor. The replacement schedule will be provided by PID. PID will provide specifications and drawings as contract documents.

Main Flushing and Replacement

The action justification identified two parts to complete main repair: flushing with resampling and replacement.

Main Flushing

All mains which return a result above the MCL will be flushed with 10 times their volume at a minimum velocity of 1 fps. The flushing will be coordinated in sequences of 500-foot lengths of pipe. The sampling intervals are at 250-feet of pipe, so the 500-foot length will center the contaminated area in the 500-foot length to be sure the length of the contaminated area is flushed out. The flushing water will be collected in water tenders and transferred to a treatment site. The recommended treatment site is the Reservoir B site. This site is PID property and has 3 million gallons of storage volume in the off-line reservoir and ample space to locate a truck coordination and treatment system. Treated flushing water will be recycled for construction water or disposed of by land application.

Following the flush, the main section will be stagnated for a 72-hour period and resampled. Services off mains undergoing flushing and sampling activities will have temporary supply. If the sample result is again returned above the MCL, the 500-foot main segment will be replaced. If the sample is returned below the MCL, the main segment will be considered for clearance.

Mains with sample results above the detection limit will be flushed one time following the same protocol as described above.

The clearance of the distribution system will be determined as part of the reconnection action.

Procurement

The flushing procedure will be performed by PID staff. PID staff are familiar with the flushing methods, requirements, and regulatory standards. A general contractor will be hired to provide the collection and treatment of the flushing water. PID will store the treated water in tanks at various places in town to be recycled for construction water. All excess water will be disposed of by the contractor with land application.

Main Replacement

Mains with second sample results higher than the MCL will be scheduled for repair. The repair materials will likely be fusible High Density Polyethylene (HDPE), Polyvinyl chloride (PVC) C900, or ductile iron pipe (DIP). The materials selected will depend on the bury depth of the pipe and the length of replaced segment. Shallow trenched mains will likely be replaced with PVC C900 or DIP. Deeper mains will be replaced with fusible HDPE.

The appurtenances which were damaged or contaminated will also be replaced during this phase.

Temporary supply will be provided to customers served by the main undergoing replacement for the duration of the replacement action.

Procurement

A geotechnical report will be completed to determine specific installation details required for the action. PID will provide plans and specifications for the main segments requiring replacement. Replacement details will include appurtenance installation details and specifications and tie-in connection details to existing mains. A general contractor will be hired to complete the main replacement action. The schedule of main repair will be provided by PID. The schedule will likely follow the pattern used for the sampling action.

Flushing Water Collection and Treatment

The flushing water generated by the main and service lateral flushing, and the lesser volume generated through sampling efforts, must be collected and treated prior to disposal. The contractor responsible for the repair and replacement action will provide the collection tanks and the treatment system. The treatment site will likely be located at Reservoir B. The off-line reservoir volume can be used for collection and storage. Additional collection or recycled water storage can be located onsite. The treatment system (likely a mobile treatment package, typical supplier is Rain for Rent) can be located at this site as well. Flushing water will be treated for the removal of VOCs to comply with recycled water and land application regulations. The treatment method will likely be a pressurized media filter. Treated water disposal will be coordinated with PID. Some portion of the recycled water will be available for construction water use. The contractor must provide the filling services for these construction water supply stations in accordance with PID needs. The contractor will be responsible for disposing all excess treated water via land application. The disposal methods must adhere to all regulatory requirements.

Meetings/Reports

Contractor shall attend weekly meetings with PID staff and other action leaders to update on the progress of the flushing and replacement action and discuss other action issues and solutions. Additionally, the Contractor shall provide daily and weekly reports of progress and issues encountered. The reports shall include, but not be limited to, progress report, overall action schedule, problems encountered, and conflicts with other actions.

Our water.
Our future.
Paradise Irrigation District

Paradise Irrigation District
Water System Recovery Plan
Reconnect Customers – Justification Report

Date: April 12, 2019
Prepared by: Michael Lindquist, P.E.
Checked by: Sheila Magladry, P.E.

Contents

Damage Description

The actions associated with the Water System Recovery Plan have identified the parts of the system which were damaged or contaminated during the Camp Fire. The Repair and Replace Damaged System Components Action has repaired or removed all damage and contaminants in the system. The Reconnect Customers Action will connect all existing and new customers to the repaired system.

Purpose of Action

The action will reconnect customers to the distribution system providing potable water. Potable water is a requirement to obtain a Certificate of Occupancy (COO) from the Authority Having Jurisdiction (AHJ) – Butte County or the City of Paradise depending on the accessor's parcel number (APN). Reconnection to the system allows residents to move back into existing or replacement structures. The action will dovetail the other recovery plan actions. Expedience is important because the economic vitality of the community relies upon residents moving back.

Customer reconnection to the system is defined as: legally receiving potable water from PID. It includes installation of a water meter and being activated in the PID Financial System.

Reconnection includes the following steps:

1. **Sampling of service lateral***
2. **Testing sample***
3. **Installation of meter box****
4. **Installation of water meter****
5. **Verification of home water testing**
6. **Verification of backflow preventer**
7. **Update PID Financial System user data**
8. **Coordinate with Other Actions**

*** -** All service laterals will have been sampled/tested as part of the Sampling Action. Additional sampling/testing may be conducted if warranted. For cost estimating, it was assumed that 10% of services laterals would be sampled/tested.

****** - These tasks differ in the subsequent alternatives.

New buildings will be built to current code requirements which include indoor fire sprinklers. Fire sprinklers likely increase the demand for a single customer. It is possible the minimum service size will be ¾". Currently 80% of the customers have a 5/8" connection. These services will likely need to be upsized. This can be accomplished as part of the customer's rebuilding project, and will need to be coordinated with building department requirements.

There may be some special circumstances where it is beneficial to change the location of the service lateral or water meter location. These will be handled on a case specific basis.

Action Alternatives

Alternative 1: Reconnect "As Soon as Practical"

Scope

The action prepares every service lateral for reconnection as soon as practical following the completion of the sampling and/or the repair and replace damaged system components actions. It is intended to prepare the PID owned equipment in order to reconnect customers at the time of request for potable water service.

"As Soon as Practical" is defined as completing sample manifold tube removal (remnant from the Asset Recovery Action), meter box installation, and verification all components are functioning as expected completed as soon as possible, and installing a water meter when a customer requests reconnection.

This effort must be coordinated with the PID records keeping office.

Setbacks to this alternative include… (loss of FEMA funding for replacements of meters and boxes… anything else?)

Estimated Cost

Aggregated total $7,600,000

Estimated Schedule

It is estimated that approximately 1300 customers will request reconnection within the first 6 months of the Action; that amount represents a majority of the occupiable structures and 20% new construction. Reconnections after the initial amount are likely to average between 20-100 per month for many years.

Alternative 2: Install All Meter Boxes and Meters Immediately

Scope

This alternative proposes to install all water meters as soon as possible following the completion of the other recovery actions. It would result in approximately 9,000 of installed water meters being dormant. Although this alternative ensures the cost of the meter installation is covered within the FEMA funding allocations, it has a host of other issues. Theft of water meters (for their salvage value) becomes a challenge. Also, it might be many years before a water meter is needed at a location, creating additional work to verify the condition of the meter at the time of reconnection (meter would be removed, tested, repaired if necessary, and reinstalled). It is NOT industry practice to leave meters dormant for long periods of time.

Estimated Cost

Additional cost this alternative adds $1,100,000 to Alternative 1's cost

Aggregated total $8,700,000

Estimated Schedule

Installation of the meter boxes and meters could likely be accomplished within 36 months (if the installation generally follows the clearing of the distribution system).

Alternative 3: Reinstall Both Meter Box and Meter as Requested

Scope

This alternative proposes to install the meter box and water meter once reconnection is requested by the customer. It would be similar to Alternative 1 during the initial action period because of the large number of requests but delay installation of meter boxes and meters for until a customer requests service.

This alternative would not take advantage of the economies of scale when installing new meter boxes, which increase this alternative's cost per installation approximately 20% more per unit.

Estimated Cost

Aggregated total $8,100,000

Estimated Schedule

It is estimated that approximately 1300 customers will request reconnection within the first 6 months of the action; that amount represents a majority of the occupiable structures and 20% of new construction.
Reconnections after the initial amount are likely to average between 20-100 per month for many years.

Action Goals

The alternatives meet the following action goals:

Goal	**Alterative 1** Recover "As Soon as Practical"	**Alternative 2** Install All Meter Boxes and Meters Immediately	**Alternative 3** Reinstall Both Meter Box and Meter as Requested
Readily Initiated	Yes	Yes	Yes
Allows customers to reconnect when requested	Yes	Yes	Yes
Minimizes disruption to District Operations	Yes	No	No
Estimated Cost	$7.6M	$8.7M	$8.1M

Selected Alternative

Alternative 1 of install all meter boxes as soon as practical and water meters as customer's request reconnection is the preferred alternative because it has the lowest cost and follows industry practices of water meter installations.

Alternative 2 was not chosen because installation of water meters before they are needed is not the industry standard and causes additional work and costs to verify meters after they have been dormant.

Alternative 3 was not chosen because the higher per unit cost of delaying meter box installation is not as cost effective as Alternative 1.

Our water.
Our future.
Paradise Irrigation District

Paradise Irrigation District
Water System Recovery Plan
Reconnect Customers - Implementation Plan

Date: April 12, 2019
Prepared by: Michael Lindquist, P.E.
Checked by: Sheila Magladry, P.E.

Contents

Action Summary

Once the distribution system is cleared for serving potable water, customers can be reconnected. The justification report determined the most cost-efficient method for reconnection is to repair/replace meter boxes as soon as practical and install meters at the time of customer request. Reconnection will include:

Sampling and Testing

All service laterals will have been sampled/tested as part of the Sampling Action. Additional sampling/testing may be conducted if warranted and will include:

Sampling of Service Lateral

If the service lateral was not replaced as part of a previous action, the service lateral shall be sampled within 30 calendar days of anticipated reconnection date to verify it is not contaminated. This test may be in addition to previous tests in other actions.

Testing Sample

Service laterals shall be tested for benzene at a minimum. More thorough testing may be required depending upon information determined during previous actions. Subsequent tasks will not be done until acceptable test results are received.

Installation of Equipment

Installation of Meter Box

Previous actions will have identified meter box damage. A meter box may be located in it's original location or relocated based on external needs. The new meter box materials and construction shall meet PID Standard Specifications and Drawings. Surface improvements around the meter box shall be completed as part of the reconnection action to prevent damage to the meter box due to other construction. The meter box would be installed when a customer requests reconnection or as "soon-as-practical" (whichever is sooner). It is likely that approximately 60% of meter boxes are damaged and will require replacement. For service lateral pipes being replaced, the meter box would be reinstalled/replaced at the same time.

Installation of Water Meter

The water meter shall be installed in the meter box when a customer requests reconnection and their portion of the distribution system has been cleared for reconnection.

Administrative Tasks

Verification of Home Water Testing

For structures that have plumbing that existed prior to when the distribution system is determined to be free of contamination there is a possibility that the customer plumbing, including the pipe from the meter box to the structure, is contaminated. Connecting the customer to the PID system creates the possibility of contaminating the distribution system from the customer's plumbing. Testing customer plumbing is the jurisdiction of the property owner and Butte County. Prior to reconnection, PID shall verify that the customer plumbing has been tested according to Butte County requirements and was determined not to be contaminated. If PID is unable to

verify, a backflow preventer may be required to be installed prior to reconnection to the system. Location of the backflow preventer will be determined by PID and will depend on the hazard potential posed by the customer's plumbing.

Verification of Backflow Preventer

If a backflow preventer is required, the PID shall verify that it is operating correctly prior to connection to the system (use annual testing requirement as an example).

Update PID Financial System User Data

Reconnections will require updating the PID financial system which tracks user data such as: water use, water meter number, customer billing information, and date of connection. Additionally, the Automated Meter Infrastructure (AMI) system requires updated meter information to allow the system to register the meter in the system and recognize/properly identify received data. This task is made more complicated because it is likely that many properties are likely to change ownership as reconnections are occurring. Careful coordination between field work and database input is necessary.

Coordinate with Other Actions

Reconnecting customers is expected to begin almost immediately, will be accomplished concurrently with other actions, and continue for years after the other actions are completed. When a customer requests reconnection, it should increase the priority of completing the other actions, i.e. sampling/testing and repairs at the property. It is anticipated that a particular reconnection will not be finalized until the distribution system supplying the service lateral has been cleared.

Special circumstances

In special circumstances, a customer will request reconnection and potable water will not be available in the nearby water main within a reasonable time period. It may be possible to supply the customer from a temporary tank, another nearby main with temporary piping (pipe or hose), or new permanent piping. Each case will be evaluated, and a determination made about the possibility of reconnection.

New buildings will be built to current code requirements, including indoor fire sprinklers. That significantly increases the potential customer flow rate demand. Each structure's sprinkler needs will be determined by a licensed professional and approved as part of the building permit process.

Procurement

The action will be accomplished though a combination of contract and PID forces.

ID	Task Name	Duration	Start	Finish
1	**Planning**	**33 days**	**Mon 3/4/19**	**Wed 4/17/19**
2	Coordination and Review of Project	10 days	Mon 3/4/19	Fri 3/15/19
3	Complete Draft Recovery Plan	14 days	Mon 3/18/19	Thu 4/4/19
4	Draft Recovery Plan Review Meeting with PID	0 days	Thu 4/4/19	Thu 4/4/19
5	Complete Revised Draft Recovery Plan	5 days	Fri 4/5/19	Thu 4/11/19
6	Submit Revised Draft Recovery Plan to CalOES and FEMA	0 days	Thu 4/11/19	Thu 4/11/19
7	CalOES/FEMA Review and Approval of Fundability	4 days	Fri 4/12/19	Wed 4/17/19
8	Review and Approval of Recovery Plan at PID Board Meeting	0 days	Wed 4/17/19	Wed 4/17/19
9	Communicate Recovery Plan to Public	0 days	Wed 4/24/19	Wed 4/24/19
10	**Project 1 - Temporary Customer Supply**	**352 days**	**Thu 4/18/19**	**Fri 8/21/20**
11	**Procurement**	**45 days**	**Thu 4/18/19**	**Wed 6/19/19**
12	Complete RFP	10 days	Thu 4/18/19	Wed 5/1/19
13	Bid Period	30 days	Thu 5/2/19	Wed 6/12/19
14	Approve Contract	5 days	Thu 6/13/19	Wed 6/19/19
15	Contract NTP for Temporary Customer Supply	0 days	Wed 6/19/19	Wed 6/19/19
16	**Supply Temporary Customer Supply systems**	**307 days**	**Thu 6/20/19**	**Fri 8/21/20**
17	Manufacture first 5 Temporary Customer Supply Systems	5 days	Thu 6/20/19	Wed 6/26/19
18	Deliver First 5 Temporary Customer Supply Systems	2 days	Thu 6/27/19	Fri 6/28/19
19	Manufacture Remaining Temporary Customer Supply Systems	20 days	Thu 6/27/19	Wed 7/24/19
20	Deliver Remaining Tempoary Customer Supply systems	5 days	Thu 7/25/19	Wed 7/31/19
21	Install and Maintain Temporary Customer Supply systems	300 days	Mon 7/1/19	Fri 8/21/20
22	**Project 2 - Recover Water Meters and Appurtenances**	**305 days**	**Thu 4/18/19**	**Wed 6/17/20**
23	**Procurement**	**55 days**	**Thu 4/18/19**	**Wed 7/3/19**
24	Complete RFP	10 days	Thu 4/18/19	Wed 5/1/19
25	Bid Period	30 days	Thu 5/2/19	Wed 6/12/19
26	Approve Contract	5 days	Thu 6/13/19	Wed 6/19/19
27	Contract NTP for Water Meter Recovery	0 days	Wed 6/19/19	Wed 6/19/19
28	Contractor Mobilization	10 days	Thu 6/20/19	Wed 7/3/19
29	**Meter and Appurtenance Recovery**	**250 days**	**Thu 7/4/19**	**Wed 6/17/20**
30	**Recover meters 0-1600**	**40 days**	**Thu 7/4/19**	**Wed 8/28/19**
31	Recover meters 0-400	10 days	Thu 7/4/19	Wed 7/17/19
32	Recover meters 400-800	10 days	Thu 7/18/19	Wed 7/31/19
33	Recover meters 800-1200	10 days	Thu 8/1/19	Wed 8/14/19
34	Recover meters 1200-1600	10 days	Thu 8/15/19	Wed 8/28/19
35	1600 meters recovered (includes approximately 250 standing structures)	0 days	Wed 8/28/19	Wed 8/28/19
36	**Recover meters 1600-3200**	**40 days**	**Thu 8/29/19**	**Wed 10/23/19**
37	Recover meters 1600-2000	10 days	Thu 8/29/19	Wed 9/11/19
38	Recover meters 2000-2400	10 days	Thu 9/12/19	Wed 9/25/19
39	Recover meters 2400-2800	10 days	Thu 9/26/19	Wed 10/9/19
40	Recover meters 2800-3200	10 days	Thu 10/10/19	Wed 10/23/19
41	3200 meters recovered (includes approximatey 450 standing structures)	0 days	Wed 10/23/19	Wed 10/23/19
42	**Recover meters 3200-4800**	**40 days**	**Thu 10/24/19**	**Wed 12/18/19**
43	Recover meters 3200-3600	10 days	Thu 10/24/19	Wed 11/6/19
44	Recover meters 3600-4000	10 days	Thu 11/7/19	Wed 11/20/19
45	Recover meters 4000-4400	10 days	Thu 11/21/19	Wed 12/4/19
46	Recover meters 4400-4800	10 days	Thu 12/5/19	Wed 12/18/19
47	4800 meters recovered (includes approximately 750 standing structures)	0 days	Wed 12/18/19	Wed 12/18/19
48	**Recover meters 4800-6000**	**30 days**	**Thu 12/19/19**	**Wed 1/29/20**
49	Recover meters 4800-5200	10 days	Thu 12/19/19	Wed 1/1/20
50	Recover meters 5200-5600	10 days	Thu 1/2/20	Wed 1/15/20
51	Recover Meters 5600-6000	10 days	Thu 1/16/20	Wed 1/29/20
52	6000 meters recovered (includes approximately 1350 standing structures)	0 days	Wed 1/29/20	Wed 1/29/20
53	**Recover Meters 6000-10400**	**100 days**	**Thu 1/30/20**	**Wed 6/17/20**
54	Recover meters 6000-6400	10 days	Thu 1/30/20	Wed 2/12/20
55	Recover meters 6400-6800	10 days	Thu 2/13/20	Wed 2/26/20
56	Recover meters 6800-7200	10 days	Thu 2/27/20	Wed 3/11/20
57	Recover meters 7200-8000	10 days	Thu 3/12/20	Wed 3/25/20
58	Recover meters 8000-8400	10 days	Thu 3/26/20	Wed 4/8/20
59	Recover meters 8400-8800	10 days	Thu 4/9/20	Wed 4/22/20
60	Recover meters 8800-9200	10 days	Thu 4/23/20	Wed 5/6/20
61	Recover meters 9200-9600	10 days	Thu 5/7/20	Wed 5/20/20
62	Recover meters 9600-10000	10 days	Thu 5/21/20	Wed 6/3/20
63	Recover meters 10000-10400	10 days	Thu 6/4/20	Wed 6/17/20
64	All meters recovered	0 days	Wed 6/17/20	Wed 6/17/20
65	**Project 3 - Sample Mains, Service Laterals and Appurtenances**	**490 days**	**Thu 4/18/19**	**Wed 3/3/21**
66	**Procurement**	**55 days**	**Thu 4/18/19**	**Wed 7/3/19**
67	Complete RFP	20 days	Thu 4/18/19	Wed 5/15/19
68	Bid Period	30 days	Thu 5/16/19	Wed 6/26/19
69	Approve Contract	5 days	Thu 6/27/19	Wed 7/3/19
70	Contract NTP for Sampling	0 days	Wed 7/3/19	Wed 7/3/19
71	Sampling Contractor Planning, Prep and Mobilization	20 days	Thu 7/4/19	Wed 7/31/19
72	**Sample, Test and Interpret Data for Meters, Mains and Appurtenances**	**415 days**	**Thu 8/1/19**	**Wed 3/3/21**
73	**Sample Services 0-1500**	**43 days**	**Thu 8/1/19**	**Mon 9/30/19**
74	Service 0-300 (includes extra time for lab testing and interpretation)	15 days	Thu 8/1/19	Wed 8/21/19
75	Service 300-600	7 days	Thu 8/22/19	Fri 8/30/19
76	Service 600-900	7 days	Mon 9/2/19	Tue 9/10/19
77	Service 900-1200	7 days	Wed 9/11/19	Thu 9/19/19
78	Service 1200-1500	7 days	Fri 9/20/19	Mon 9/30/19
79	1500 services sampled (includes approximately 250 standing structures)	0 days	Mon 9/30/19	Mon 9/30/19
80	**Sample Services 1500-3000**	**35 days**	**Tue 10/1/19**	**Mon 11/18/19**
81	Service 1500-1800	7 days	Tue 10/1/19	Wed 10/9/19
82	Service 1800-2100	7 days	Thu 10/10/19	Fri 10/18/19
83	Service 2100-2400	7 days	Mon 10/21/19	Tue 10/29/19
84	Service 2400-2700	7 days	Wed 10/30/19	Thu 11/7/19
85	Service 2700-3000	7 days	Fri 11/8/19	Mon 11/18/19
86	3000 services sampled (includes approximately 450 standing structures)	0 days	Mon 11/18/19	Mon 11/18/19
87	**Sample Services 3000-4500**	**35 days**	**Tue 11/19/19**	**Mon 1/6/20**
88	Service 3000-3300	7 days	Tue 11/19/19	Wed 11/27/19
89	Service 3300-3600	7 days	Thu 11/28/19	Fri 12/6/19
90	Service 3600-3900	7 days	Mon 12/9/19	Tue 12/17/19
91	Service 3900-4200	7 days	Wed 12/18/19	Thu 12/26/19
92	Service 4200-4500	7 days	Fri 12/27/19	Mon 1/6/20
93	4500 services sampled (includes approximately 750 standing structures)	0 days	Mon 1/6/20	Mon 1/6/20
94	**Sample Services 4500-5700**	**35 days**	**Tue 1/7/20**	**Mon 2/24/20**
95	Service 4500-4800	7 days	Tue 1/7/20	Wed 1/15/20
96	Service 4800-5100	7 days	Thu 1/16/20	Fri 1/24/20
97	Service 5100-5400	7 days	Mon 1/27/20	Tue 2/4/20
98	Service 5400-5700	7 days	Wed 2/5/20	Thu 2/13/20
99	Service 5700-6000	7 days	Fri 2/14/20	Mon 2/24/20
100	6000 services sampled (includes approximately 1350 standing structures)	0 days	Mon 2/24/20	Mon 2/24/20
101	**Sample Services 5700-10400**	**101 days**	**Tue 2/25/20**	**Tue 7/14/20**
102	Service 6000-6300	7 days	Tue 2/25/20	Wed 3/4/20
103	Service 6300-6600	7 days	Thu 3/5/20	Fri 3/13/20
104	Service 6600-6900	7 days	Mon 3/16/20	Tue 3/24/20
105	Service 6900-7200	7 days	Wed 3/25/20	Thu 4/2/20
106	Service 7200-7500	7 days	Fri 4/3/20	Mon 4/13/20
107	Service 7500-7800	7 days	Tue 4/14/20	Wed 4/22/20
108	Service 7800-8100	7 days	Thu 4/23/20	Fri 5/1/20
109	Service 8100-8400	7 days	Mon 5/4/20	Tue 5/12/20
110	Service 8400-8700	7 days	Wed 5/13/20	Thu 5/21/20
111	Service 8700-9000	7 days	Fri 5/22/20	Mon 6/1/20
112	Service 9000-9300	7 days	Tue 6/2/20	Wed 6/10/20
113	Service 9300-9600	7 days	Thu 6/11/20	Fri 6/19/20
114	Service 9600-9900	7 days	Mon 6/22/20	Tue 6/30/20
115	Service 9900-10400	10 days	Wed 7/1/20	Tue 7/14/20
116	All Services Sampled	0 days	Tue 7/14/20	Tue 7/14/20
117	Re-sampling/Monitoring of Repaired Areas	330 days	Thu 11/28/19	Wed 3/3/21
118	**Project 4 - Repair, Replace Damaged System Components**	**394 days**	**Thu 6/20/19**	**Tue 12/22/20**
119	**Procurement**	**55 days**	**Thu 6/20/19**	**Thu 9/5/19**
120	Complete RFP	10 days	Thu 6/20/19	Thu 7/4/19
121	Bid Period	30 days	Thu 7/4/19	Thu 8/15/19
122	Approve Contract	5 days	Thu 8/15/19	Thu 8/22/19
123	Contract NTP for Repair and Replacement	0 days	Thu 8/22/19	Thu 8/22/19
124	Mobilization	10 days	Thu 8/22/19	Thu 9/5/19
125	**Replace Damaged Services 0-500**	**50 days**	**Thu 9/5/19**	**Wed 11/13/19**
126	Replace Services 0-500	50 days	Thu 9/5/19	Wed 11/13/19
127	500 Damaged services replaced (represents 1500 sampled)	0 days	Wed 11/13/19	Wed 11/13/19
128	**Replace Damaged Services 500-1000**	**33 days**	**Fri 11/22/19**	**Tue 1/7/20**
129	Replace Services 500-1000	33 days	Fri 11/22/19	Tue 1/7/20
130	1000 Damaged services replaced (represents 3000 sampled)	0 days	Tue 1/7/20	Tue 1/7/20
131	**Replace Damaged Services 1000-1500**	**33 days**	**Wed 1/8/20**	**Fri 2/21/20**
132	Replace Services 1000-1500	33 days	Wed 1/8/20	Fri 2/21/20
133	1500 Damaged services replaced (represents 4500 sampled)	0 days	Fri 2/21/20	Fri 2/21/20
134	**Replace Damaged Services 1500-2000**	**33 days**	**Mon 2/24/20**	**Wed 4/8/20**
135	Replace Services 1500-2000	33 days	Mon 2/24/20	Wed 4/8/20
136	2000 Damaged services replaced (represents 6000 sampled)	0 days	Wed 4/8/20	Wed 4/8/20
137	**Replace Damaged Services 2000-3500**	**99 days**	**Thu 4/9/20**	**Tue 8/25/20**
138	Replace Services 2000-2500	33 days	Thu 4/9/20	Mon 5/25/20
139	Replace Services 2500-3000	33 days	Tue 5/26/20	Thu 7/9/20
140	Replace Services 3000-3500	33 days	Fri 7/10/20	Tue 8/25/20
141	All Damaged Services Replaced (represents 10,400 sampled)	0 days	Tue 8/25/20	Tue 8/25/20
142	Rehabilitate or Replace Mains	335 days	Wed 9/11/19	Tue 12/22/20
143	**Project 5 - Reconnect Customers to Metered Potable Water**	**357 days**	**Thu 10/24/19**	**Fri 3/5/21**
144	Services 0-1500 (250 Standing Structures)	25 days	Thu 10/24/19	Wed 11/27/19
145	Potable Water Service Reestablished to the first 250 Standing Structures	0 days	Wed 11/27/19	Wed 11/27/19
146	Services 1500-3000 (200 Additional Standing Structures)	20 days	Wed 12/25/19	Tue 1/21/20
147	Potable Water Service Reestablished to 450 Total Standing Structures	0 days	Tue 1/21/20	Tue 1/21/20
148	Services 3000-4500 (300 Additional Standing Structures)	30 days	Mon 1/27/20	Fri 3/6/20
149	Potable Water Service Reestablished to 750 Total Standing Structures	0 days	Fri 3/6/20	Fri 3/6/20
150	Services 4500-6000 (600 Additional Standing Structures)	60 days	Mon 3/9/20	Fri 5/29/20
151	Potable Water Service Reestablished to 1350 Total Standing Structures	0 days	Fri 5/29/20	Fri 5/29/20
152	Potable Water Service Reestablished Support Additional Reconstruction	200 days	Mon 6/1/20	Fri 3/5/21